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Included in this issue as a slip-in is a chapter from The State of Food and Agriculture 1958 *on the growth of forest industries*

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FAO — The Food and Agriculture Organization of the United Nations — grew out of a United Nations Conference held at Hot Springs, Virginia, U.S.A., in May 1943. The nations agreed to work together to secure a lasting peace through freedom from want. The Organization was formally founded at Quebec, Canada, in October 1945. It was located at Washington D.C. until 1951 when the Headquarters office was moved to Rome.

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It attempts to cover a range of interest as wide as that of the Forestry Division whose work it mirrors. Signed articles express the opinions of the authors and do not necessarily represent the views of the Organization. All material in ***Unasylva*** may be freely reprinted, but acknowledgement is requested, together with a copy of the publication containing the reprint.

Cover Photograph: *Loading pulpwood in the far north of Canada, the greatest exporter of pulp and paper in the world. There are 80 pulp and paper companies, some large and some small, operating 130 mills. On 18 September 1958 the new buildings of the Pulp and Paper Research Institute of Canada were officially opened at Pointe Claire, Quebec. The Institute is the industry's focus for fundamental research and for the nurturing and development of scientific and engineering brainpower.*

Courtesy: Euclid Road Machinery Co., Cleveland, Ohio.

Unasylva

An International Review of Forestry and Forest Products

A BANKER'S VIEW OF FOREST INDUSTRIES

A major problem for forest industries is to find the necessary capital for development. Because of this, the views of bankers on forest industries are always of interest. Recently, the General Manager of the Svenska Handelsbanken was invited to address the Annual Meeting in Stockholm of the Swedish Association of Paper and Pulp Engineers. Many of the points made on that occasion, although directly addressed to a Swedish audience, bear recapitulation.

"We are often tempted to gaze through the veils that hide the future but seldom are we so justified in doing so as when we discuss forest industries. There are two main reasons. Firstly, forest industries are dependent on a harvest that takes decades to reach fruition and, consequently, all planning must be done long in advance... Secondly... forest industries require larger capital investments than most other industrial enterprises. In fact, investment capital per worker in the paper and pulp industry is considerably higher than the corresponding figure for industry as a whole. The greater an industry's capital requirements, the greater the need for accurate estimates of the future trend since the risk of failure is proportional to the size of the investment...

The production structure of forest industries has been characterized by a successive shift towards the manufacturing of more refined products. This is in itself quite a natural phenomenon... Emphasis has gradually switched from sawn and planed timber to paper pulp, and from paper pulp to paper and board. At present, production of timber products is, in terms of volume, on about the same scale as before the war, while pulp production has risen by 40 percent and the output of paper and board by more than 100 percent...

An interesting feature of this trend is that, at the same time as every phase has been characterized by the development of more highly refined products, it has been possible to use raw materials of poorer quality. Stunted timber, waste and hardwood — which were considered as more or less worthless until quite recently — have become of increasing importance as raw materials...

But production trends... have to an even greater extent been influenced by developments on the world market... Production has tended to increase at a more rapid rate than exports. Since the war, total world production of timber goods has risen by about 40 percent while total exports of the same products are largely unchanged. World production of pulp has been practically doubled, but exports have only risen by some 20 percent... In the sphere of international trade we are at present living in a world of mixed aims. On the one hand, efforts are being made to liberalize international trade to a greater extent than hitherto. On the other hand, most countries are seeking to achieve a greater degree of self-sufficiency as regards forest products, especially so in the case of paper and board and, to some extent, pulp. It is quite obvious that this is seeking to push the ball towards the other goal and bring about an improved division of labor and specialization between the countries of the world...

The future prospects of our forest industries are a mixture of both favorable and unfavorable factors. On the one hand, the market may continue to offer room for rapid expansion even in the future, and the current plans for a free trade area may well present great opportunities... On the other hand, we must allow for the possibility of continued expansion being hampered by a shortage of capital. This brings us to the question as to whether these industries cannot reduce their capital requirements by means of suitable economies. The task will not be an easy one, but the problems and the possibilities are the subject of keen attention...

One sphere in which I feel that... forest industries must be prepared to invest a great deal of capital and large labor resources is research and, by research, I mean both applied research and pure research. In particular, efforts must be directed towards long-term development work in which technical process research, product development and market assessment are coordinated so as to achieve a final aim.

Finally, I should like to repeat that we should not take too pessimistic a view of the problems of finding the necessary capital. We must find a solution simply because we cannot afford to let our forest industries slip into the doldrums. After we have continued for a time with a policy favoring certain other sectors of the economy we may realize that, when all is said and done, it is industry that forms the basis of a national economy and, in our case in particular, forest industries. It may then be realized that there is little point in adding upper stories to our national house without, at the same time, strengthening the foundations on which it is built."

FIGURE 1. – *Mangrove forests in Surat-thani, Thailand. The important species in these forests belong for the most part to the family Rhizophoraceae.*

Courtesy, Royal Forest Department, Thailand

FIGURE 2. – *Changa manga plantations following seeding-cutting (Pakistan). These are irrigated plantations in dry zones.*

Tropical Silviculture

Irvine T. Haig
Chief, Forest Technology Branch*
Forestry Division, FAO

This article is an excerpt from the FAO publication entitled Tropical Silviculture, *prepared by I. T. Haig, M. A. Huberman and U Aung Din, which summarizes the highlights of similarity and differences among the major forest formations in the tropics. The physical and silvical features of the wet evergreen (rain), moist deciduous, and dry deciduous forests are compared as a basis for discussing the silvicultural practices which have been developed in Asia, Africa, and Latin America. Future research and field experiments needed to fill gaps in existing knowledge are outlined as a guide to tropical silviculturists.*

Tropical forests constitute almost half of the world's forest area. Widely dispersed in three major world regions, Asia, Africa and America, they contain an enormous quantity of renewable raw material in a world of rapidly growing needs. Their proper management on a permanent basis is one of the most complex and exacting tasks confronting professional foresters. This study attempts to sum up, from a world standpoint, the information now available on one major phase of this task, the natural regeneration of tropical forests, as a guide to the future development of sound silvicultural practice.

Though the task is a formidable one, it is aided by the fact that each major formation shows striking resemblances in physiognomy, structure, succession and other silvical features in response to climate and other environmental factors in all three world areas in spite of the great dissimilarities in flora and the presence of a multitude of edaphic, floristic and altitudinal variants requiring special and localized consideration. Climate, and particularly rainfall and rainfall pattern, are especially influential and permit grouping most tropical forest vegetation in three broad formations, arranged according to increasing dryness and deciduous character; namely, wet evergreen (rain) forest; moist deciduous forest; and dry deciduous forest, including thorn and scrub forest. This has greatly simplified consideration of formations roughly similar in physical environment and silvical characteristics despite the great areas and general complexity of the forests involved. The Table on page 160 summarizes the broad comparisons that can be made from a world viewpoint on the basis of present knowledge. In addition, three special forest types of great current or potential economic importance are dealt with in some detail. Nevertheless, although the physical environment and major silvical features of each major formation appear reasonably clear, there are obvious gaps in knowledge for all major areas and types.

In general, knowledge and practice have progressed further in Asia than in Africa and America, in botanical fields such as dendrology, as well as in strictly silvical and silvicultural fields. In addition, in both Asia and Africa, well-organized research agencies and active research programs promise rapid advance, with such institutions and programs limited in scope and mostly in initial stages in America. Nevertheless, lack of knowledge is a definite hindrance to the development of fully dependable silvicultural practices, while the growing availability of funds that can be invested in such practices, and the necessity of seeing they are usefully employed, makes the forester's task increasingly difficult.

In the major climatic groups recognized here (wet evergreen, moist deciduous and dry deciduous), the development of silviculture has been dominated in most forests by the problems created by the relative great complexity of tropical forests, especially as regards the large number of species, greatly intermixed, combined with markets limited to a few species of high commercial value. Only with good markets, as in the dry fuel forests of India and Pakistan, gregarious stands of commercial species or areas with large supplies of cheap labor, have adequate natural regeneration practices been applied on substantial areas, areas relatively restricted in terms of world totals. Elsewhere in these major formations, in all three regions, commercial harvesting is still largely logger's selection consisting of the removal of the few valuable stems per unit of area, with little or no provision for future productivity, except the establishment of minimum girth requirements to preserve younger or smaller-growing stock of commercial species, sometimes supplemented by improvement cuttings. The problem is to maintain, and possibly increase, the proportion of such valuable commercial species.

One of the most striking aspects of tropical forestry to date has been the manner in which the problems created by floristic richness have been circumvented, sometimes with impressive and outstanding success, by concentration of forestry attention and effort upon relatively few of the large number of tree species present. Fortunately, in all or almost all important tropical forest formations, one or more species or species groups, sometimes gregarious, have combined commercial values with adequate to excellent silvical features. Indeed, current tropical silviculture can almost be written in its entirety in terms of a small number of such superior species or species groups: teak, sal, limba, okoumé,

* Dr. Haig has since rejoined the U. S. Forest Service.

PHYSICAL AND SILVICAL FEATURES OF THE MAJOR CLIMATIC FOREST FORMATIONS

Item	Major forest formations		
	Wet (rain)	Moist	Dry
Physical factors			
Temperature	Frost-free Little diurnal or seasonal fluctuation Mean: 78° F. (25° C.)	Essentially frost-free More diurnal and seasonal fluctuation Mean: 75° F. or less (24° C. or less)	Essentially frost-free Marked fluctuations Mean: 70-90° F. (21-32° C.)
Insolation (radiation)	Not high: 40-50 percent of possible	Higher	Very high
Wind	Light: 3-7 m.p.h. (5-12 km.) Hurricanes	Gentle to moderate: 6 m.p.h. (10 to 20 km.) Hurricanes	Moderate to strong Drying
Humidity	Very high: 90 percent	High: 60-80 percent (sal: 45-60 percent in March)	Medium high: 50-60 percent
Rainfall	80+ inches (2,030 mm.)	50-80 inches (1,270-2,030 mm.)	Under 50 inches (1,270 mm)
Rainfall pattern	No real drought: up to two months dry; four months at extremes	Seasonal drought: up to four to six months dry; seven at extremes	Marked drought: up to six to eleven months dry; eleven and a half at extremes
Soils	Very varied Leached Lateritic	Very varied Not as leached Fertile	Very varied Not leached Fertile with water Some alkaline and saline
Silvical factors			
Physiognomy	Evergreen Three-tree strata No leafless period Lianes and creepers common Stands closed - luxuriant	Semi-deciduous Two- to three-tree strata Brief leafless period Lianes and creepers present Stands closed - luxuriant	Deciduous One- to two-tree strata Long leafless period Lianes and creepers rare Stands closed to open and ragged
Height	Trees tall - dominants 140 to 180 feet (43 to 55 meters)	Trees tall to medium - dominants 80 to 120 feet (24 to 37 meters)	Trees short - dominants 50 to 75 feet (15 to 23 meters)
Flora	Very rich in species Greatly intermixed Rarely gregarious	Less rich in species Greatly intermixed Occasionally gregarious	Least rich in species Intermixed More commonly gregarious
Commercially valuable species	Present and aggressive	Present and very aggressive	Present and very aggressive
Uncontrolled fire and grazing	Little to none	Frequent	Frequent
Succession	Climax	Toward wet forest	Sometimes toward moist forest
Seed production	Satisfactory to abundant: periodic	Satisfactory to abundant: periodic	Profuse: often annual
Dissemination	Wind and other	Wind and other	Wind and other
Germination	Good to excellent Leading species with limited viability	Good Some species with limited viability	Good Retain viability well
Establishment	Fair to good Coppice well	Negligible to fair Coppice strongly Dieback feature common	Negligible Coppice strongly Dieback feature present
Development	Light-demanding Grow well on release	Strongly light-demanding Grow well on release	Strongly light-demanding Very hardy
Hardiness	Hardy	Hardy Fire-resistant	Fire-resistant

Spanish cedar, mahoganies and other *Meliaceae*, the dipterocarps, bamboos, mangrove, etc. Progress, indeed all forestry activity, has depended primarily, in its initial stages, on the discovery and recognition of such species, beginning with their commercial qualities and advancing to concentrated efforts to learn how to use these commercially valuable species to replace or enrich the forest estate. Such efforts have often taken the course of compensatory plantations, or the enrichment or replacement of mixed forests through artificial regeneration, for many of these species possess excellent silvical as well as merchantable qualities.

Insofar as natural regeneration is concerned, these favorable qualities have permitted the use of a variety of forest practices, often dependent in moist and wet types on the ability of desirable species to establish themselves adequately under the shade of natural forest (as in much rain forest), or to regenerate satisfactorily at the time of cutting (as with teak), if assisted properly with necessary measures to assure adequate seed production, soil preparation and tending. Knowledge is still incomplete for all types, even for species as advanced as teak, while the problems of securing the establishment of adequate quantities of desirable species in most moist and wet forests, and their proper maintenance by tending, leave unsolved a great multitude of complex problems. The question of establishment of natural regeneration of any kind is also made increasingly difficult as rainfall quantity becomes lower and recurrent drought more frequent and severe. Sal, though in general an aggressive species, illustrates the difficulty of securing establishment in an environment in which frost, over-wet periods, recurrent drought, frequent fires and similar undesirable environmental features, are coupled with periodic seeding and a limited period of seed viability. This causes difficulties in securing natural regeneration by canopy manipulation or other appropriate silvicultural measures at any given time or place, the only condition under which a silviculturist may be properly said to have adequate control of practice. In most dry forest types, though the floristic pattern is less complex, the example of teak and sal illustrates the tendency towards purity of composition. In these types, natural regeneration is only feasible in vegetative form, as through coppice sprouts. Similar though diverse problems for the special types discussed, mangrove, bamboo and conifers and the special research needs growing out of them, are covered in the pertinent literature, including papers presented to the Fourth World Forestry Congress, and are not further elaborated in the study, *Tropical Silviculture*, Volume I.

In summary, though much progress has been made in spite of incomplete knowledge and limited markets, material expansion of natural regeneration practices will require not only the improvement and perfection of present knowledge and methods but the extension of knowledge and practice to forests and species not now merchantable. Admittedly, this is a formidable task, in view of the complexity of tropical forests and their wide geographic distribution, and despite the general similarity in environment and silvical character within each major formation in all world regions, and the probability that silvical problems and patterns may be alike in broad context, the focal point of this particular study. Under these circumstances, an expansion of research activities and large-scale trials to furnish information on costs and practicability of methods, as well as silvicultural results, would seem essential. Though more extensive knowledge on as wide a scale as possible seems highly desirable, it appears to be a practical necessity to concentrate on the most promising species and species groups and on the most productive fields of botanical and silvical knowledge. Tropical forestry literature (including the report of, and the papers presented to, the Tropical Forestry Section of the Fourth World Forestry Congress) contains many useful and detailed suggestions as to fields and projects for research activity by major forest formations and types.

It would indeed seem worthwhile, therefore, to indicate only the major fields of definite value and promise.

In this connection, past progress has obviously advanced most rapidly by:

1. *Broadening markets*
   (permitting expansion of silvicultural practice to many areas now economically inaccessible due to current lack of such species or now operable by commercial selection only).

FIGURE 3. – Bombacopsis sepium, *a frequent and economically interesting tree species of the moist deciduous forest of northern South America, merging into rain forests with characteristic lianes and palms.*

Courtesy, Jorgenson

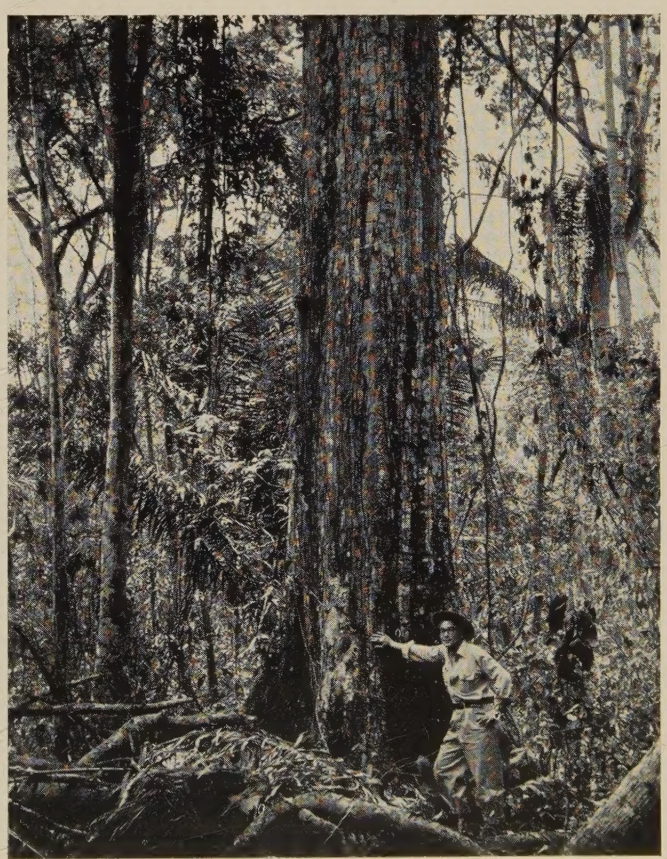

FIGURE 4. – *Natural regeneration of teak* (Tectona grandis) *in kyathoung* (Bambusa polymorpha) *flowered area.*
Courtesy, Pyinmana Division, Burma

2. *Silvical research*
(on methods of enriching future stands by increasing the proportion of the more promising species Such silvical aspects as seeding habits, factors affecting establishment, crop protection, behavior of various species under the shade of mature forest and ability to compete in mixed forest and form a satisfactory commercial crop both quantitatively and qualitatively, have proved especially important).
3. *Investigation of reduction of costs*
(tending complex stands, such as by improved poison-girdling practices or reduction in expensive weeding operations).

Future programs might well include:

(*a*) Inventories to show what species are available in accessible stands in economic sizes and quality and in sufficient quantity to assure a satisfactory commercial supply. Accurate botanical identification of such trees is required, including identification in seedling and pole stages.

(*b*) Technological studies to determine the more promising of these species, regardless of present marketability, i.e., those with superior wood qualities from a commercial standpoint. Such studies should include not only normal tests of anatomical, physical and mechanical properties, but also tests of seasoning and machining qualities, durability, ease of preservative treatment, etc.

(*c*) Studies of silvical qualities especially of the more promising species, and of methods of increasing the proportion of these species in future stands. In this respect the following aspects are of the greatest importance in the design of initial silvicultural practice:

(*i*) *Seeding habits.* Frequency and abundance of seeding; character of dissemination; conditions necessary for germination.

(*ii*) *Tolerance.* Especially ability to survive under full shade, form advance reproduction, respond and grow satisfactorily after release and under degrees of light and competitive conditions.

(*iii*) *Hardiness.* Resistance to insects, disease and other destructive agents.

(*iv*) *Productivity.* Rates of growth: ability to form a satisfactory commercial crop, in both quality and quantity.

(*v*) *Reduction in silvicultural costs.* Studies and large-scale trials, aimed at eliminating or reducing the costs of expensive cultural operations, e.g., eliminating unnecessary clearings or release cuttings. The proper use of controlled fire and grazing, appropriate measures to train and supervise skilled labor crews, and improvement of poison-girdling techniques.

(*d*) Large-scale comparisons of promising regeneration methods to determine what is economi-

cally feasible and practical, in a forest where commercially desirable species are ordinarily few and sparsely scattered through the forest, extraction costs high, and funds, labor and technical skills often very limited.

Substantial and expanding work along these lines is now under way in all three world areas. Sound research organizations are essential, staffed by intelligent and imaginative personnel well trained in modern research techniques. This will be particularly important as practice intensifies and new and possibly less aggressive species must be dealt with. Close association with administrative and operating staff is also needed in developing areas to help conduct the pilot plant or commercial-sized tests under sufficient controls, to test fairly new methods and procedures in actual application, and to furnish adequate information on costs. Each country and region might well examine its research and technical organizations with these thoughts in mind.

Finally, greatly expanded interchange of information and personnel between the various tropical areas is justified by the impressive similarities between various tropical formations in silvical features and the resultant possibilities of parallel silvicultural patterns in widely separated world areas. Such exchange should involve (i) published material (as in technical articles and bulletins); (ii) large-scale world conferences (as the Fifth World Forestry Congress, the Inter-African Forestry Conferences and the British Commonwealth Forestry Congresses); and (iii) direct contact of personnel (technical seminars and study tours).

FIGURE 5. – *Applying sodium arsenite to a frill girdle — rain forest in Malaya.*

Courtesy, Malayan Forest Service

FIGURE 6. – *The woods of Gabon, which are world-renowned. Prior to the second world war, 400,000 tons were being exported, principally to Germany. Here an okoumé has been felled, to be retailed at the sawmill.*

Wood Utilization Research in the Philippines

George M. Hunt
FAO Technical Assistance Officer

Foresters everywhere are alert to the necessity of maintaining and increasing forest production by better forest practices, and by reduction of losses by insects, fungi, fire, and shifting agriculture. They are even working to develop hybrid species that grow more rapidly and produce wood more quickly than the parent species, thus increasing the potential productive capacity of the forest land. But all these efforts must be supported by more efficient harvesting and utilization of the forest crop, for it is of little use to grow more timber and then throw a large part of it away. In the more highly developed countries of the world, relatively little wood goes to waste although there is still the possibility of finding higher uses for much of it. But in the regions of the world where great areas of virgin forest still prevail, only about one quarter to one third of the wood growing on the land reaches the consumer in the form of finished products. The rest is left on the land to rot or is lost as bark, sawdust, shavings, slabs, trimmings, defective pieces, and in other forms as the log progresses through the various manufacturing steps that convert it into consumer products. The waste is caused by the inability of the logger or the manufacturer to find profitable uses for his residues.

The problem is especially great in tropical countries where there are so very many species of timber but only a relatively small number find commercial use. The noncommercial species in the forest must wait until research provides profitable ways to use them or the scarcity of wood becomes sufficiently acute to force them into use despite their unpopularity. In the Philippines, for example, there are some 3,000 species of trees that grow to one foot or more in diameter but, at most, only about 200 species find use and only about 60 of these are commercially important. Most of the 2,800 remaining species are not plentiful but all of them undoubtedly could be used commercially in some form or other if their properties were thoroughly understood.

The tonnage of wood and bark that goes to waste in the Philippines every year is enormous, and this is potential raw material for innumerable industries that could provide employment for thousands and increase the contribution of the forests to the welfare of the nation without increasing the drain on the forests. When the world's population was small and the forests covered the earth, efficiency in wood utilization had no significance. Now that population is increasing at so fast a rate and forests are shrinking rapidly, the whole tree must be utilized and not just part of it. Research and industrial development provide the means to bring this about.

The forest products research institute

Research in wood properties and utilization is a modern necessity in any country blessed with abundant forests. General recognition of this fact is evidenced by the number of countries that have already established research laboratories for this purpose, and in addition, there are a number of new laboratories being established and old ones being enlarged.

For many years, foresters in the Philippines have recognized the need for a comprehensive program of forest products research but until recently they were unable to do much about it. Nevertheless, some very useful research in this field was done piecemeal by members of the Bureau of Forestry, the Philippine Bureau of Science, and the College of Forestry. It was not until 1954, however, that the dream of a separate forest products laboratory devoted solely to research and development on the properties, uses and industrial applications of wood became a reality. In November of that year the forest products laboratory main building was completed in Mount Makiling National Park, not far from Manila, and a small staff moved into it and began to install equipment. During the following years the number of buildings has been increased to six, the amount of machinery and equipment tripled and the total staff increased to about 160, of whom more than half are college graduates. The forest products laboratory was first established as a division of the Bureau of Forestry but on 5 July 1957 it was separated from that bureau and reorganized into the present semiautonomous Forest Products Research Institute, attached for policy purposes to the University of the Philippines.

The development and growth of this institute is an outstanding example of international co-operation and personal teamwork. FAO has, since April 1954, provided a technical assistance expert to assist the Philippine Government in equipping and staffing the institute, training members of the staff and developing its research program. In addition, FAO has provided the services of five specialists at different times for periods up to twelve months, to give special assistance in their respective fields, which included timber testing, pulp and paper research and veneer, plywood and gluing research.

The buildings and grounds, some of the equipment and the salaries of the workers are provided by the Philippine Government, most of the equipment has been furnished by the United States International Co-operation Administration (ICA) but substantial amounts of equipment have been received as Colombo Plan donations from the United Kingdom and Australian Governments. A large contribution of books for the technical library was made by the Rockefeller Foundation.

Some 26 members of the institute staff are now undergoing training in the United States, Australia and India or have completed their training and returned to their jobs. This training has been made possible by all the co-operating organizations named above in addition to universities in the United States and the Smith-Mundt-Fulbright program of the United States. Many other individuals and organizations have made contributions of one kind or another to the equipment, the library or the success of the institute — so many, in fact, that it is impractical to list them.

A more notable example of worldwide co-operation in the success of a single research institution would be hard to find and, fortunately, this co-operation is continuing and even expanding. As a result, the Philippines now has a research institute in full operation that is probably the most outstanding of its kind in Asia: and it is still growing and progressing toward greater things. It will undoubtedly make great contributions in future years to the knowledge about wood and wood utilization, particularly the tropical woods of Southeast Asia and neighboring island countries. It will thus be a living monument to the many organizations and individuals whose contributions made it possible.

Research program

The research program in the early years of such a forest institute must be largely of the exploratory or survey type, to learn the strength, durability, specific gravity, shrinkage, seasoning properties, treating properties, chemical composition, fiber dimensions, pulping and paper-making properties and other properties and uses of all the commercially important woods and, eventually, of all the tree species of the Philippines. At the same time, studies must be made to develop improvements in processing to reduce waste or improve the final product and to search for new industrial uses for which wood now wasted can be employed.

The necessity for concentrating on the survey type of work in the beginning is due in part to the lack of knowledge of the basic properties of Philippine woods. This information is urgently needed commercially and must be obtained as quickly as possible. It is also due in part to the lack of training and experience of most of the staff in scientific research. As the experience and competence of the staff increases, however, and they

FIGURE 1. – *Front view of the main building of the Philippine Forest Products Research Institute (formerly Forest Products Laboratory). The building, located among the tropical vegetation of Mount Makiling National Park 70 kilometers south of Manila, was first occupied by a very small staff in November, 1954.*

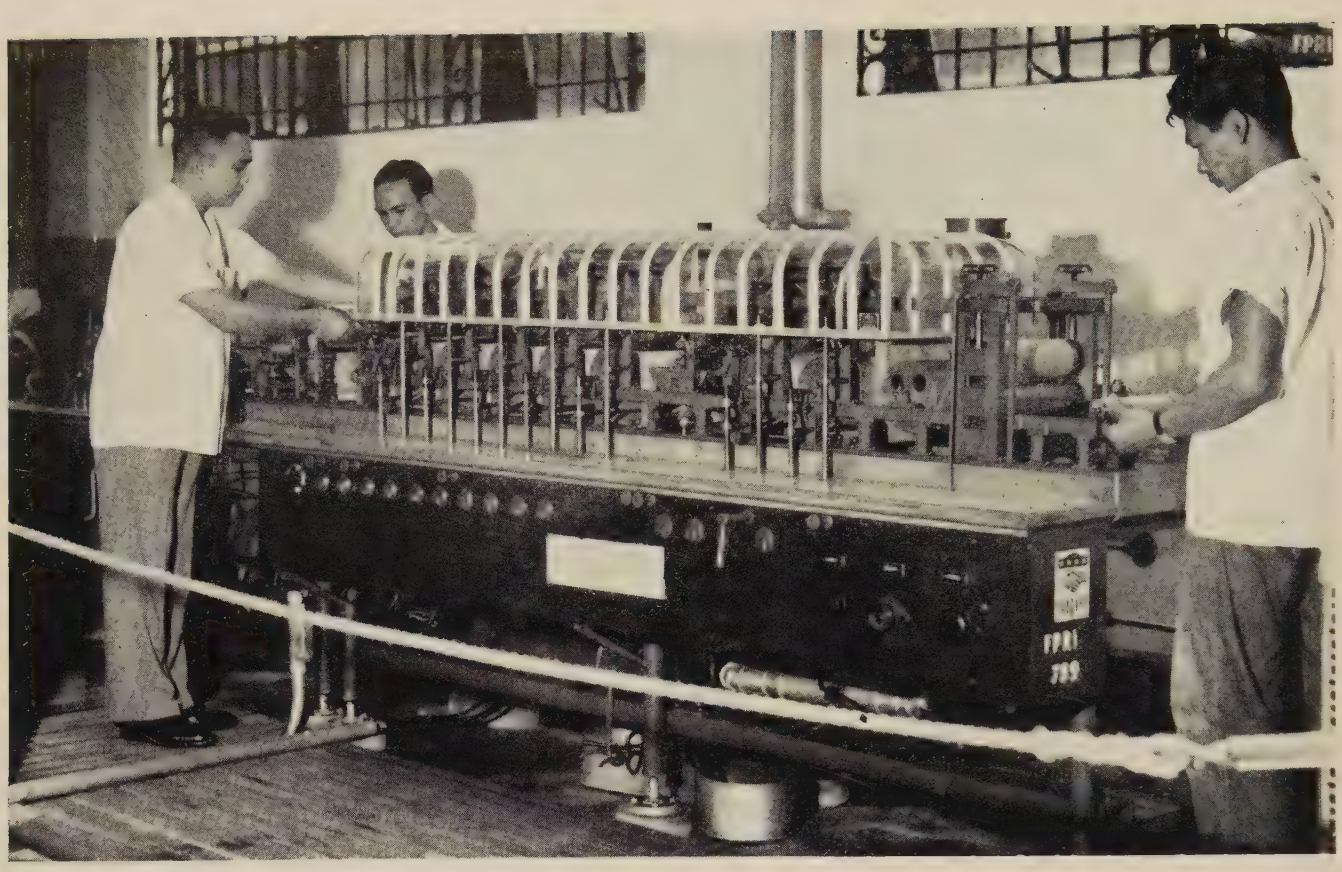

FIGURE 2. – *"Midget" Fourdrinier paper machine that produces a continuous sheet of 8.5 inch. (21.5 centimeter) wide paper in a variety of thicknesses. Over 125 different papers have thus far been made on this machine from hardwoods, bamboos, abaca, bagasse and mixtures.*

develop their initiative and understanding, these empirical studies will gradually give way to more scientific investigations.

The research and development being done by other forest products laboratories are a great help to the new institute and provide much information of immediate applicability to Philippine conditions, without the necessity of repeating the entire research. Some of the work of other countries will have to be repeated, however, to learn how the results apply to Philippine woods and conditions.

The research program of the institute is organized into the same general lines of work as are common in other forest products laboratories. In some details the assignment of individual projects to the research divisions is not entirely logical but this is recognized and will be corrected later as opportunity permits.

Chemical investigations

Emphasis is being placed at present upon the pulping of Philippine woods, bamboos, and agricultural waste fibres such as abaca, bagasse, rice straw and the like. Agricultural crop fibres, of course, are not forest products but, since no other public institution in the Philippines is equipped for research in pulping and paper making, the pulping of these fibres has been added to the research program of the institute.

The Philippines is almost entirely a paper-importing country yet it has enormous wood resources that can be made into highly useful pulps and papers. One plant is pulping sugar cane bagasse on a substantial scale and making it into good paper. There are a number of other paper and paperboard mills in and around Manila but they use either imported pulp or waste paper. The work of the Forest Products Research Institute has already demonstrated that good marketable papers in great variety can be made from most of the Philippine hardwoods and bamboos that have been tried, as well as from abaca fibres and bagasse. It is believed that there are few woods, if any, in the Philippines that cannot be made into marketable paper of some kind, either alone or in mixtures with other woods or fibres.

The institute has a Fourdrinier paper machine that makes a continuous sheet of paper 8 ½ inches (21.5 centimeters) wide. Over 125 machine runs have been made thus far in which usable papers have been produced from a wide variety of species or mixture. Experiments and demonstrations have also been made in other countries on certain Philippine woods and bamboo and excellent papers have been produced from them. There is no longer any question that the Philippines can make practically all the paper it requires from its own wood and fibres. The principal problem now is how to raise the capital, build the mills, and start production, although much research work must still be done in the refining of methods to produce specific papers and to provide the answers to the innumerable individual problems that will be met. Obviously, no pulp and paper mill

should be built without thorough economic studies in addition to the purely technological studies that can be made in the laboratory.

Another phase of the work of the Chemical Investigations Division is the production and briquetting of charcoal. This will be largely demonstration work because both production and briquetting of charcoal have been widely practiced in other countries for a long time and the equipment and methods are known. Charcoal is produced in the Philippines also and one industrial company is using about 1,000 tons of lump charcoal per month. A great deal of dust or " fines " is produced in handling the charcoal which is more difficult and less satisfactory to use than the larger lumps. Briquetting should overcome this difficulty. Some of the dense hard woods make a strong charcoal that handles well but the softer woods produce weaker, more fragile lumps. When using logging waste and mill waste for making charcoal the hard woods and the soft woods will be " coaled " together. Grinding and subsequent briquetting should produce a uniformly dense and industrially desirable fuel from the mixture. A complete, small-scale charcoal briquetting plant that will produce about 500 pounds (227 kilograms) of briquettes per hour is now being installed and will be used to determine the feasibility of this process and to provide briquettes for industrial trials.

Wood technology

The manufacture of veneer and plywood in the Philippines is growing rapidly and the makers are meeting numerous problems on which research can be helpful. A complete veneer and plywood plant of small size is being used by the institute in studies to determine the correct knife angle and nose-bar setting in the veneer lathe to produce best quality veneer from different species and to study the many problems in the machine drying of veneer and the details of gluing it into plywood of acceptable export grade and testing the results. The gluing characteristics of the common commercial Philippine woods are also to be determined preparatory to their expected use in the production of laminated timbers. The relative suitability of different kinds of glue for safe use under the high humidity conditions of the Philippines is also being studied, as well as the extent to which they may safely be diluted with cheaper materials in the manufacture of plywood.

Basic studies are being made, of course, upon the strength of the different Philippine species to help improve the efficiency of their use for building construction and all other uses for which strength and toughness are important. In this work, as well as in specific gravity and shrinkage studies, the plan is to test the wood of at least five different trees from each of three rainfall regions in estimating the averages for the species. The rainfall regions are classed as very wet, very dry, and intermediate. It is a rough classification indeed but about the best that can be made. It will make it possible to determine whether the differences in rainfall have a noticeable influence on the average and the range of properties of the several species.

From the beginning, the institute has adopted the policy of selecting its test trees in the woods, taking botanical specimens to be filed in the herbarium as evidence of correct species identification and recording in great detail data on the location from which the tree was obtained, the nature of the soil upon which it grew, the elevation and slope of the land, the other species in the immediate vicinity and various other details. This is somewhat burdensome but is necessary where there are so many species. After a sufficient number of trees have been tested, these records will make it possible to analyze the data for any species or group of species, in various ways, including the influence of soil type, soil moisture, latitude, elevation, rainfall and other factors upon the properties of the wood.

The Entomology Section of the Division of Wood Preservation is studying the insect enemies of wood, of which the Philippines has more than its share, and is searching for practical means of controlling them. The four major groups to contend with are the subterranean termites, the dry-wood termites, the powder-post beetles, and the log-boring ambrosia beetles. Each in its own way destroys or devalues enormous quantities of wood each year. Information available from the work of other countries on the control of these insects is being used to the fullest extent and publicized while experimental work is being directed towards field trials and demonstrations to get the most useful protective methods into practice, as well as to search for better methods.

The Pathology Section is studying the wood-staining and wood-destroying fungi of the Philippines and methods for their control. The staining fungi are of particular interest as they affect the production of rattan for export and the production of wooden shoe soles (bakya) for domestic use. In both cases great loss of value is caused but in rattan production it is especially severe. As much as one half of the total rattan canes cut may be so badly blue stained as to become practically valueless before reaching their destination. In both cases, the basic need is not to obtain new information but to induce the operators to apply the known methods and materials for stain prevention. In this instance as in many others, it is easier to determine what should be done than it is to get people to do it.

The problem of decay prevention is also mainly a problem of inducing people to avoid the conditions that favor decay or to use appropriate preservative treatment. The Preservative Treatment Section is studying the relative ease of treatment of different species in the hope of finding species in addition to apitong that take treatment readily and also to devise good treating methods for species that must be used but are resistant to preservative penetration. In this work, the section will be assisted by a small but complete high-pressure treating plant that will apply preservatives at pressures up to 1,000 lbs. per square inch (70 kilograms per square centimeter).

FIGURE 3. – *Microscopist measuring the dimensions of wood fibres. The fibre dimensions of more than 100 species of woods and bamboos have been measured so far and the results published.*

In the Seasoning Section, the principal problem is to classify the commercial Philippine woods into groups with regard to ease of kiln drying and to develop drying schedules for each group that will accomplish the most rapid drying consistent with a minimum of degrade. Drying schedules have been developed for certain species in previous years but it is believed they can be materially improved.

As in other countries, some species in the Philippines are so nearly alike in structure and appearance that they cannot be distinguished by examining the wood, even under the microscope. This is true of red lauan and tangile both of which are commercially important. One of the projects in the Wood Anatomy Section of the Wood Technology Division, therefore, is the search for methods of distinguishing these species from each other. The 3,000 tree species of the Philippines offer unlimited opportunities for this section to develop identification keys and compare anatomical characteristics. The section is also studying fibre dimensions of woods and bamboos in order to classify them with regard to their potential usefulness in paper making. Over 100 species have thus been classified and the results made public.

The future

Lack of space prevents mentioning the many other studies of interest and importance that are included in the research program for the fiscal year 1958-59, which includes a total of about 90 projects, large and small. Some of these projects must continue in the program for many years while others are of such character that they can be completed in a few months. Each project is described individually in the annual research program which is issued about 1 July, with a brief description of past results and plans for the future. Practically every project is covered by a detailed working plan which describes the objectives of the project and outlines the plan of attack. Such detailed plans may be less necessary in an institute of long experience but they are highly important in a new institute with a largely inexperienced staff.

The transition from the survey type of research into scientific pioneering beyond the boundaries of present knowledge will be gradual and can be accomplished only after more of the staff have undergone the disciplines of further academic training and have developed the competence required to earn the doctorate degree or equivalent. No member of the staff has thus far earned this degree and only a few have attained the Master of Science level. The dearth of skilled scientists and science administrators is serious in countries that are technologically underdeveloped and is an obstacle that must be overcome as rapidly as possible at the Forest Products Research Institute. In the beginning, trainees were sent abroad by the institute to learn by doing in other institutions the tasks they would be assigned to on their return. This seemed necessary in order to get the survey type of work under way as quickly as possible. Now the emphasis is being placed on postgraduate academic training for advanced degrees.

Although the Forest Products Research Institute is just beginning, it has already provided much useful information to industrial entrepreneurs in the Philippines and some of it has been converted into successful manufacturing operations. It has also been able to settle certain disputes. For example, a local paper manufacturer found a large shipment of foreign pulp unacceptable because he could not make good paper from it, yet the foreign pulp manufacturer represented it as high-quality material. Seller and purchaser together brought a sample of pulp to the institute where examination under the microscope showed it to be of good quality and a laboratory paper machine run produced good wrapping paper from it. It was found that the paper manufacturer had not been beating the pulp properly and, when this failure was corrected, the pulp proved entirely acceptable.

One wood product manufacturer had a great deal of wood waste. At the same time he was importing paper for saturating with asphalt. At his request he was shown how the waste could be converted into a saturating paper by a relatively simple method and he immediately devised equipment for the purpose.

Specific help has been given in the selection of local species for the manufacture of venetian blinds, tool handles, pencils, piano parts and other articles. Inventors or process developers have been helped over seemingly insurmountable obstacles resulting from their lack of equipment or knowledge.

In short, the institute is being increasingly consulted as it becomes better known and its influence and usefulness are constantly growing. There is every reason to feel sure that it will make great contributions to science and industry in the years ahead.

Mediterranean Forestry

FAO Staff[1]

As a result of ecological and human action, the forests of the Mediterranean area are composed of stands of low density and slow growth. The timber produced is hard, heavy and crooked, more suitable for fuelwood than for industrial use.

These characteristics are aggravated by the facility of vegetative propagation, and a heavy undergrowth often limits the production of timber in quantity and quality, even though coppices yielding relatively large amounts of fuelwood often have a productivity superior to that of high forests. On the other hand, the climatic conditions favor all products such as cork, resins, tannins and essences, which are connected with the anatomic and reproductive processes of the trees rather than with their vegetative capacity.[2]

It is one of the most serious aspects of Mediterranean forestry that while general demand for sawn timber and pulp, which are the typical products of temperate forests, has been rising — at times at rather spectacular rates — the markets for the products of Mediterranean forests have been closing one after another. It is true that new techniques are beginning to make possible the utilization of wood of small dimensions, but the fact always remains that the Mediterranean forest has a substantially low productivity. This has led to consideration as to whether a change in silvicultural methods might not be able to reverse the present difficult situation of Mediterranean forestry, mainly as regards the production of industrial timber.

The need for a change is less urgently felt in the forests located in the zones of transition towards temperate and humid climates. Here, the establishment of forests similar to those growing in Central Europe does not encounter too many difficulties, and hence the transformation of stands with a view to increasing the output of structural timber and pulpwood appears feasible. The conversion of coppice into high forests, the artificial introduction of coniferous species, etc., are examples of this transformation already under way in many parts of the region. Any discussion on the applicability to the Mediterranean forests of silvicultural systems (for example, uniform systems versus selection systems) derived from Central European practices, would probably be more useful if restricted at first to the transitional temperate zones.

As regards forests situated in the Mediterranean zones proper, or those with climates of transition towards aridity, a more profound change in present silvicultural methods is probably necessary. In fact, the special conditions of his environment has long since led Mediterranean man to transform the original forests into park type forests or into tree plantations yielding mainly resins and bark, etc. These latter types of forest present forms quite different from those of the temperate-humid forest, where classical silviculture was born. The full utilization of this typical Mediterranean stand frequently calls for labor and techniques borrowed from agriculture, and thus a new, highly intensive silviculture is formed, fairly dependent on agricultural methods. In fact, forestry techniques in the Mediterranean zone are enlarging their scope far beyond the old limits of classical silviculture.

The time is ripe for discussing: first, to what extent, if any, the methods of classical silviculture are still valid for the Mediterranean area; secondly, the main lines of a new silviculture; and thirdly, how to apply these new methods to the Mediterranean forests in order to obtain from them products of high value.

A shift in emphasis of silviculture towards more intensive treatment yielding an output of higher value is neither new nor limited strictly to this particular zone. Throughout European countries there is a growing realization that the classic type of forest does not entirely satisfy the needs of a growing economy.[3] Statements that the classic forest is a slow-growing formation mainly aimed at enriching the soil; that natural regeneration is often capricious; that total production is relatively low and shows little variety, etc., are beginning to appear in the most influential forestry periodicals.

Trends in Silviculture

The general trends in silviculture in Europe have been as follows.

Classical silviculture

The main characteristics are: pure, even-aged stands, in some cases of artificial origin; clear fellings; preference for low thinning; supremacy given to questions of economics, and therefore a tendency to neglect certain types of natural forests; drawing-up of rigid working plans; well-defined concepts of age and rotation; definite notion of " normal forest ". In this type of silviculture,

[1] A paper prepared for the Sixth Session of FAO's Mediterranean Forestry Subcommission, Madrid, April 1958.

[2] A. Pavari, " Bases écologiques et techniques de la sylviculture dans les pays méditerranéens, " *Monti e Boschi*, No. 10, 1954.

[3] Yves Claudel, "Nos besoins en bois de papeterie nécessitent des techniques de production rapide ", *Revue Forestière Française*, November 1957.

the stand is the main preoccupation of the silviculturist and trees are regarded mainly only in so far as they are the elements making up the stand. It could even be said that mathematics is the basic line of thought in this concept (order should reign in the forest) and that dendrometry is the applied science at the basis of silviculture.

This concept of silviculture may be described as classical, since it can be traced to as far back as the beginning of the nineteenth century. The birth of silviculture as a science was made under the auspices of this concept, which is closely connected with the names of Hartig and Cotta. The methods established by these two foresters gained the upper hand during the last century, and it was not until the twentieth century that strong objections to these methods began to arise. The numerous disadvantages which result from their systematic employment were stressed: impoverishment and degradation of the soil, loss of production, difficulties of regeneration, invasion of insects, etc. As a result, silviculture shifted its attention towards biology and a new trend was thus delineated.

Modern silviculture

Nothing symbolizes this trend better than the slogan " Back to Nature ". It was encouraged by the big developments taking place in the fields of phytosociology and pedology in the first decades of this century. The biological sciences now take the place formerly occupied by mathematics. The study of ecology, phytosociology and pedology becomes the foundation of silviculture. The forest is no longer composed merely of an assembly of trees placed on the same area, but of a complex of biological associations in an equilibrium, in which all factors, even those which formerly appeared unimportant, are of importance for the well-being of the whole. Therefore, the tree as an individual comes to the fore and becomes the protagonist of silviculture. In fact, as Guinier has said, " To understand the forest is to understand the tree ".

This modern silviculture is distinguished above all by a return to the precepts of the " natural forest " (from which derives a certain caution with regard to exotic species), complete freedom from theoretical plans or schemes, more intensive treatment, very short cutting cycles, careful and precise fellings, frequent and repeated cultural operations, etc.[4] It has been said that the modern silviculturist truly " fashions " his stands, devoting particular attention to every tree. This is made possible by the relative absence of administrative restrictions; much freedom is given to the " man on the spot ".

This new fashion spread rapidly in Europe. It encountered a favorable reception in France, where foresters had been brought up with Parades' celebrated phrase: " To imitate nature, to hasten its work, this is the basic maxim of silviculture ". But even in the country of Cotta, the evolution was initiated as early as the beginning of the century, mainly by Mayr through his book, *Waldbau auf Naturgesetzlicher* (Silviculture in Conformity with Nature). The trend has rapidly dominated European silviculture, which has become enriched with several important developments such as " jardinage ", " selective improvement ", " management by control ", etc., in which the spirit of modern thinking has been crystallized.

As already said, this evolution has been encouraged by the development of the biological sciences. Development is still in progress, and it is to be expected that silvicultural evolution will also continue. In fact, a third type of silviculture seems to be emerging, whose development may be decisive in particular for the future of Mediterranean forestry.

The new silviculture

The new silviculture is, to no small extent, a result of increased needs for forest products, and of the development of vegetative selection. On poor soils natural evolution leads to stands yielding a very low output. In addition, the original natural forests are either disappearing almost everywhere as a result of human action or else their products are no longer required. In many cases, therefore, the return to a natural " climax ", particularly by natural means, is hardly to be desired.

The progress made in vegetative selection and tree hybridization has given fresh hope for a better utilization of soils by trees. The use of selected clones and hybrids in modern poplar cultivation, accompanied by very intensive treatment of the stands, has permitted yields never attained by the classic forest — in fact, ten or twelve times the yields of the latter. Similarly, the introduction of selected types of willow, although still in its experimental stages, would seem to promise unexpected, almost fantastic, yields per unit.

Obviously, these selected clones or hybrids are expensive and can only be used with the maximum benefit on very well prepared soils and through intensive tending. It seems as if silviculture now aims at suiting the environment to the tree; and this would, indeed, be the final stage in an evolution which has passed roughly through the following stages: neglect of the environment, subjection to the environment, adaptation of the environment. There is, in fact, a growing realization that modern silviculture cannot consist of a simple return to nature, and that foresters should not refrain from establishing stands which are entirely different from the natural ones, nor reject any means of increasing yields: fertilizers, irrigation, working of the soil.[5]

A new, intensive type of silviculture is therefore envisaged, in which the ecotype, the clone or the hybrid is the protagonist (the stand thus being composed of repetitions of " the same tree ") and in which there is almost constant human intervention. On such a basis, the characteristics of the new silviculture inevitably become:

[4] P. Fourchy, " Quelques aspects de la sylviculture contemporaire ", *Revue Forestière Française*, May 1952.

[5] H. Franz, " Naturgemässe oder standortsgemässe Waldwirtschaft ", *Allgemeine Forstzeitung*, Hochschule für Bodenkultur, Vienna, No. 68, November 1957.

even-aged stands of artificial origin, mainly through planting; intensive working of the soil, use of fertilizers, pruning, etc.; clear felling to reap the products.

An illustration of the new trend is provided by the action taken by some paper companies. For instance, the Spruce Falls Company at Kapuskasing, Ontario, whose annual output is 300,000 tons of paper for the *New York Times*, has begun an important afforestation project aimed at covering its wood requirements. The project is to be carried out in natural forests of *Picea mariana*, owned by the company and where the yields no longer satisfy the needs of the mill. More striking is the example of Japan. Although natural forests cover 61.8 percent of the land area, the new five-year forestry plan aims to raise forest productivity by artificial reforestation, stressing intensive systems of forest management and the development of forest tree breeding projects.

Studies recently carried out by Paterson and Weck [6] on the correlation between natural environment and potential productivity of the forest cannot but favor this new evolution. The findings of these two distinguished scientists, taken in conjunction with the fact, recently established by research, that productivity is practically independent of methods of thinning,[7] enables

[6] S. S. Paterson, *The Forest Area of the World and its Potential Productivity*, Department of Geography, Royal University of Göteborg, Sweden, 1956.
J. Weck, "Climate and potential productivity of forests" *Forstarchiv* No. 11, Hannover, November 1957.

[7] R. Schober, "Deutung und Aussage der Durchforstungsversuche: II. Die Buchen-Durchforstungversuche", *Allgemeine Forstzeitschrift*, Munich, No. 33-34, 21 August 1957.

Figure 1. – *Artificial plantations with fast-growing species (poplars at Santa Fé, Granada, Spain).*

Courtesy, Giordano

Figure 2. – *Mediterranean park-forest managed mainly for grazing and fruit production (oak stands in Turkey).*

FIGURE 3. – *Mediterranean natural pine forests* (Pinus laricio) *in Cyprus.*

> that pure planting has, as yet, led to any major disasters. Nor, in the author's opinion, are any such disasters immediately imminent."

As to the impoverishment of the soil, the well-known pedologist, Duchaufour,[9] may be quoted:

> "The forester therefore disposes of two methods of action for exerting a favorable influence on soil evolution: a natural, long-term method, by the maintenance of a biologically balanced stand, which itself ensures the conservation of its fertility; this is the method employed by traditional silviculture, and though extremely slow, it is usually sure. An artificial method, more immediately effective, through the combined use of working of the soil and of fertilizers or ameliorators: this method is more rapid, but also more violent, and therefore more dangerous; it should be put into practice only with the necessary scientific guarantees, hence after a complete study of the environment."

us to begin to discover the production ceiling of natural silviculture. Paterson, for instance, considers that the productivity of natural forests under the very favorable natural conditions of equatorial stations with high rainfall, does not surpass the figure of 17 cubic meters per hectare, inclusive of non-utilizable wood, roots, etc. Under these circumstances, it seems clear that supplementary energy must be afforded to the complex climate-soil, if higher outputs are to be expected.

It will now be asked what has become of the former apprehensions about the disease potential and the impoverishment of the soil in pure stands. As regards the former, pathologist, T. R. Peace,[8] writes:

> "The author has no desire to deny that, in general, the disease potential of a pure stand is higher than that of a mixed one containing the same species. Though it may be desirable to remember that the most devastating tree disease so far encountered, chestnut blight (*Endothia parasitica*), destroyed chestnut in America mainly in mixed stands. It can be said that almost all agricultural crops are more liable to disease than their wild counterparts, nevertheless, the yield of usable material is invariably higher under managed cultivation. It is often suggested that this is due to the use of modern chemical disease-control methods, most of which are not applicable in forestry outside the nursery. But surely it is unnecessary to resign ourselves to the belief that we cannot elaborate methods of control lying between these inapplicable chemical methods on the one hand, and a slavish faith in the mixed "natural" forest on the other. In any case, there is little evidence in Great Britain

It must be admitted that silviculture as here described should more accurately be defined as tree farming. This does not imply that the new forestry techniques must be exactly the same as those used in agriculture. It means that forestry, like agriculture, should be improved through the use of techniques based on the knowledge accumulated about artificial tree crops, until a new stage is reached in which the trees grown and crops produced are superior to those resulting from natural stands. In most countries, admittedly, forestry is largely based on the use of existing, more or less natural forests, just as agriculture, in some very backward places, is based on the use of existing, more or less natural herbage. But if wood is to continue to occupy an important place in the economy, it would probably be advisable to keep in mind the idea of improvement beyond the limits set by nature.

Foresters may therefore now have to face two different tasks, one dealing with the natural forest and the other more with wood crops. It will be up to the forester to ensure the best management of natural stands, from which the maximum range of benefits must be drawn. But a new method — tree farming — seems to be open for producing wood of the quantity, quality and price required by an expanding economy. For this, many new techniques will still have to be elaborated.

[8] T. R. PEACE, "Approach and Perspective in Forest Pathology", *Forestry*, Vol. XXX, No. 1, 1957.

[9] PH. DUCHAUFOUR, "L'action des divers types d'humus sur les processus d'entraînement dans le sol forestier", *Revue forestière française*, December 1957.

Mediterranean Silviculture

The aim of present-day forest management, by various methods of cutting, is to allow the annual leaf fall, branches, barks, fruits and detritus from cutting, to remain in the forest. It is the decomposition of this residue which supplies the soil with those elements which render possible a sustained yield.

In Mediterranean forestry, on the other hand, seeds, branches, bark, etc., which contain the greater proportion of mineral nutrients, are in most cases removed from the forest. In fact, it is the production of fruits, fodder, extracts, etc., which makes high demands on the soil, that gives to Mediterranean forestry its distinctive character.

This feature has necessitated treatments very different from those used in forestry proper, a situation that has long been understood both by foresters and forest owners of the region. Foresters have often warned about the impoverishment of forest soils owing to the removal of foliage and fruits. That forest owners are aware of the special Mediterranean conditions is clearly shown in the present intensive treatments carried out in most *encinares* and *montados* in the Iberian peninsula, in the best chestnut stands in Italy and in those of Valonia oak in Turkey. The survival of the chestnut as an important element in Mediterranean forestry is due, to a large extent, to a change from methods based on pure silviculture to an intensive forestry based on tree farming.

It seems, therefore, that an increase in the specialized production of Mediterranean forests is mainly dependent on the improvement of straight tree farming methods. Genetical selection and breeding of types, for instance, has frequently been pointed out as one of the most promising techniques to be adopted. Vieira Natividade[10] has indicated the importance of selecting clones and of intensifying research into vegetative reproduction as regards the cork oak. A better knowledge of the techniques of pruning and of the working of the soil in conjunction with fertilization and disease control is also urgent, in order to increase the production of fruits in the *encinares*.[11] The case would not appear to be very different for the production of resins.

But increasing the production of so-called accessory products is not the main challenge to be met by Mediterranean forestry. To obtain sawnwood and pulp of the required quality, and above all in the required quantity, is an urgent need. In meeting the demand, the experience already gained by Mediterranean foresters in tree cultivation could be very valuable. The work already undertaken in Italy for the simultaneous production of better timber and better fruits in the same chestnut stands, by means of tree cultivation, would seem to show clearly the future direction to be followed by Mediterranean forestry.

[10] V. Natividade, *La Suberaie méditerranéenne - Situation et perspectives d'avenir*, Lisbon, 1956.

[11] M. M. Bolaños, *Consideraciones sobre los encinares de España*, Instituto Forestal de Investigaciones, Madrid, 1943.

Future of the natural Mediterranean forest

There still remains the problem of what policy to follow as regards the existing natural forests. In general the policy will depend on the physical, economic and social roles which the forests in question are still playing. Their economic role is considerably diminished. There remains their protective role and, to a lesser extent, closely dependent on local conditions, the social role. Are the roles played by these forests sufficiently important to justify keeping them under their present form of management?

If it is thought that the answer is affirmative, then it is essential that forest research should evolve methods of evaluating in terms as concrete as possible the physical and social benefits rendered by these forests, so that their claims can be asserted against the advantages of other competitive uses of the land. This has a very close bearing on the solutions to be decided for the present problems of the mountain areas of the Mediterranean. The possible solutions here range between maintaining mountains and hills as forest reserve, with light complementary forest industries, while agriculture and grazing continue at a subsistence level for a small population, and the retaining of the present populations on the land by every means possible.

If, on the contrary, it is thought that the answer is negative, then the only alternative is to render the forests economic, without forfeiting the social and physical benefits they may still afford. This can, in fact, be achieved by purely silvicultural methods, such as the introduction of conifers, the transformation of coppice into high forests, etc. The applicability of these courses is mostly confined to the more humid zones, and the conversion of unproductive hardwood areas into the desired forest types can be more expensive than the establishment of plantations.[12] Under these circumstances, it may be wondered whether the straightforward adoption of tree plantations should not be the central theme of every Mediterranean country. It is probable that artificial plantations will alone be capable of easily supplying those ample quantities of wood that, no matter what the technological qualities, will always constitute the essential basis of forest industries for the area.

Unfortunately, in the Mediterranean region, the establishment of tree plantations can be seriously hampered by the hunger for agricultural land resulting from the pressure of population. Here then is a dilemma to be resolved so far as the future of Mediterranean forestry is concerned.

[12] " Stand conversion costs varied from $ 43.57 to $ 80.92 per acre, depending on the hardwood control method employed. Such costs are considered far in excess of those feasible for plantation establishment. These costs should be borne in mind by foresters acquiring land for planting with pulpwood or sawtimber production as the objective. Recently abandoned fields where brush has not yet completely occupied the site can be planted at a more reasonable cost and will present fewer forest management problems ". *Bulletin 403*, West Virginia University Agricultural Experiment Station, October 1957.

Power-Lines over the Forest

B. Simonsson
Swedish State Power Board

Few people give thought to the problems presented by the ever-spreading march of electric power-lines across woodlands and forests. The matter is largely taken for granted. Yet it raises a number of interesting points for the forester and, at the request of FAO, the writer here describes what has been done in Sweden to lessen the damage caused to the forest by the erection of power-lines.

The Swedish state power-line grid now extends to about 35,000 kilometers and the area covered by forest strips under the lines or otherwise affected by them is estimated to add up to about 120,000 hectares. For some 20 years studies have been made on how to secure safe electrical transmission at the least cost and with the least damage to the forest. The particular methods adopted as a result in Sweden may not be of general application but the underlying principles should be valid.

The original way of creating a forest strip for a power-line was to cut down all trees of a height that would cause damage to the wires or pylons if they fell towards it, such trees being technically called danger trees. The area under the line was clearcut and no vegetation higher than low brush was afterwards allowed to grow up. This method, of course, provides a high degree of security but inevitably the damage to the forest is considerable and the consequent compensatory costs to be paid to forest owners are high.

A first step towards lowering costs was to classify power-lines into two broad groups: lines of national importance whose functioning could not be allowed to be interrupted even for brief intervals; and secondary lines for local needs. The standard of maintenance of the forest strips under the latter group was relaxed and it was conceded that the risk of short interruptions, caused for instance by falling trees during storms, must be accepted.

Essential power-lines

Maintaining a forest strip under a power-line of essential importance still means, therefore, that no danger trees can be tolerated. All trees when they have grown to a critical size, must be cut. But it is no longer necessary that they be entirely felled.

Trials have been made with lopping the tops of danger trees, especially in scenic areas to avoid creating unsightly gaps. The experience with this top-cutting has been favorable, and it has gradually become evident that top-cutting can be used as a general practice. In fact it is now accepted that top-cutting under Swedish conditions has many advantages.

When trees have to be felled to maintain the security of a power-line, the forest owner suffers because the timber is cut before reaching maturity and full economic value, and because disposing of the logs often requires a disproportionate amount of extra work. These direct losses can be costed and compensation claimed. But an owner may often be caused also indirect losses. The danger trees are often the dominant stems that are wind-firm. If they are removed, the neighboring trees may suffer heavily from wind damage or exposure until they have developed sufficient power of resistance.

Figure 1. – *The vegetation under this 200,000-volt power-line gives shelter to wild animals and protects the soil.*

FIGURE 2. – *Top-cut trees under a 200,000-volt powerline.*

When, however, a tree is correctly top-cut, its timber increment and the protective functions which it exercises are not unduly affected. It can be left standing for a long time without risk and the owner can cut it down whenever he pleases. The loss of potential timber or pulpwood production is decreased and compensatory payments to owners are reduced proportionately.

It has been found that at least *Pinus sylvestris* on not too productive soils can be permanently stopped in height growth even at an early stage by a correct use of top-cutting methods. The procedures should, as far as Swedish experience goes, be as follows. The trees on a strip which is often quite wide (up to 40 meters for one single power-line) should be subject to a first thinning, giving the individual stems and crowns plenty of space to develop without, however, encouraging rapidly growing hardwoods. Often the thinning should be repeated and then the stems allowed to develop as high as is permissible. At that stage the tops should be cut off. As few as possible of the upper branches (which possess the ability of replacing the top of the tree) should be retained, and it has often proved advantageous to cut off also the outer parts of the upper branches of the remaining crown.

An operation of this kind can result in vigorous young stands that even after removal of the upper branches seem to be capable of producing peeler logs under a power-line where the permissible height growth is only 8 meters. In any case, even if high-quality assortments are not possible, a good production of pulpwood can be obtained even under rather difficult growing conditions.

Such crops have not only a market value. The stands provide cover for wild animals and game, and afford protection against erosion and soil degradation. But it is, of course, the economic aspect which makes this practice attractive. It has been found as a rule that a tree can be top-cut at no bigger cost than is required for felling it: in many cases, top-cutting is the cheaper operation. This means that top-cutting with the subsequent production of a usable crop of wood has the advantage over clear felling of unusable stems. This is particularly so in the case of small forest owners who are able to undertake some or most of the topping work themselves.

It must be pointed out, however, that any operations involving danger from electricity cannot be allowed to be undertaken by private landowners on their own initiative. This work must be done by or under the supervision of specially trained people. The production of usable wood under electric power-lines, therefore, necessitates co-operation between the owner of the line and the forest owner.

For heights up to 8 to 10 meters, top-cutting is done with special tools fastened to the end of insulated rods. A small saw is the most useful tool. For greater heights the operation must be carried out by climbing the tree. Special climbing-shoes of an American type have been in use in Sweden for some years. They allow easy climbing of bare stems as well as within the crowns, and permit walking on the ground.

A point to be noted about strips on which trees are to be allowed to grow is that the stands must never be so dense that the power-line cannot easily be inspected, and repairs must be possible. However, repairs are not often required and, if necessary, a repair gang can with very little waste of time make the fellings necessary for their work. The off-chance of repairs being needed should not be permitted as a reason for the total prohibition of stands capable of producing usable wood. If on this pretext conifers are in fact not allowed, the strips will often become covered with a far more dense cover of hardwoods which require expensive cutting and chemical sprayings to be kept under control.

Top-cutting has been criticized to some extent on aesthetic grounds. The results on some occasions have indeed been eyesores but this has generally been because the work was carried out with less care and knowledge than was desirable. Top-cutting, if carefully performed by experts, is not scenically objectionable. On the contrary, it often results in stands that give an almost normal impression, and few observers, professionals or otherwise, can without careful examination tell whether a forest near a power-line has been subjected to

top-cutting. Some years after an operation, the crowns often give the impression of belonging to much older trees.

Of course, there are other possibilities for putting to use forest strips, other than growing timber. In valleys the soil is often better than average and the height to the electric wires considerable. That can of course improve the possibilities for making nurseries or growing Christmas trees but, especially on moist soils, a very good production of grazing and browsing for animals is possible. This can afford sanctuary for game animals which can be especially useful in countries where intensive forestry precludes other areas being available. In this connection, however, it is to be noted that in many countries chemicals are increasingly being used to control fast-growing hardwoods, particularly under power-lines, and if any forage production for wild animals is intended, the use of such chemicals must be carefully planned.

Forest strips under power-lines must not of course be used for storing anything inflammable. They cannot for instance be used as log landings during summer time. Winter use for log storage can be allowed if simple precautions for workers operating in the strips are observed.

Secondary power-lines

As has been said, the risk of interruptions to secondary power-lines by falling trees can be permitted to a limited degree. This means that there is a possibility of narrowing the forest strips under them. Any narrowing of the forest strips under power-lines must of course inevitably involve some dangers. Even during normal fellings, a tree can by accident fall towards the power-line and act as a conductor for the electric current. For this reason alone all forest owners are required to notify when trees are to be cut near a power-line and to state what assistance is required. This assistance is rendered free by the power companies and to any extent necessary.

The first step taken in Sweden to narrow the strips was not very astute. The strips were narrowed to give about 5 meters space on each side of the line, resulting in a total width of 10 to 12 meters. In such funnels storms caused considerable damage both to trees and power-lines. To avoid storm damage, therefore, the next step was to narrow the forest strips up to the limit of electrical security. This finally ended up in cutting practically no strip at all, leaving only a very narrow tunnel for the lines.

Strangely enough, this method has been a success. The tunnels, so far as experience goes, result in much better security than the semiwide strips and less damage is caused to the forest.

A certain technique has had to be developed to ensure that the tunnels can be maintained even in vigorous young stands. The critical moment is when the tops of the trees are going to pass the wires. By removing the branches on the power-line side of the crowns, the tops of the trees are caused to bend away

FIGURE 3. – *Under this power-line (130,000 volts) an 8-meter high vegetation can be allowed. Now, at an age of 20 years, the top-cut trees have produced pulpwood. In a not too distant future even peeler logs will be available.*

FIGURES 4 and 5. – (Left) *Vegetation round this 20.000-volt power-line being prepared to form a tunnel type forest strip. The top branches have been removed on the power-line side of the trees.* (Right) *Established tunnel type forest strips along a 30,000-volt power-line.*

from the line: this is especially noticeable when the crowns are loaded with snow. Some years later the trees are again allowed to continue to grow unhampered and the result is something very much like a narrow tunnel.

Of course, it is essential to remove weak stems or trees with weakened root system; and thinnings, if done at the right time, will have a favorable effect on the stability and development of the stems. Beyond that the tunnels need very little attention once they have been established, and it seems probable that they could function satisfactorily for many years with only light maintenance costs.

Experience with this method has now extended over more than a decade and beyond doubt it is satisfactory. For instance, in 1956 a storm passed over the western parts of south Sweden, causing very considerable damage. Thousands of trees were blown down in just those districts where the tunnel practice has been established, but a rapid survey of the grid system showed that only two trees had fallen over power-lines, causing slight trouble, whereas on either side of the lines the forests had suffered heavy windfalls. This surely affords evidence that by using the correct technique to establish power-line strips of tunnel type, the stems are, if anything, strengthened.

FAO At Headquarters

Wood features prominently in the furnishings and interior decorations given by Member Governments which help to make the meetings rooms in the FAO buildings at Rome a setting worthy of a Specialized Agency of the United Nations.

The office (right, above) *of the Chairman of the FAO Conference has been furnished by France. The Minister of Food and Agriculture, India, is shown* (right) *handing over the India Room to the Director-General of FAO "as a token of our faith in FAO's generous aims and achievements". The wall paneling is of teak and the furniture of Andaman padank.*

The Canada Room (left) *is paneled in maple, and the tables and chairs are birch. A relief map of Canada, mounted on aluminium, covers one wall: the Provinces are depicted by various woods — birch, Douglas fir, maple, cedar, chestnut, white pine and elm. There is also in the room a replica of the plaque at the Château Frontenac, Quebec, commemorating the formal creation of FAO in 1945.*

The Australian Room (right) *where the tables and chairs are in Queensland maple* (Eucalyptus Flindersia Brayleyana) *has not yet been fully completed. The Director-General's Programs and Policy Board meets regularly in this room. On the wall hangs a portrait of Frank L. McDougall, the Australian who was intimately and influentially active in the creation and development of FAO, and who was the trusted adviser of successive Directors-General until his death in Rome in 1958.*

The Queen Juliana Room (left) *a gift of the Netherlands, is partly paneled in snake wood* (Loxoperygium sargotti) *from the Netherlands Antilles. The table surround is of palissander* Dalbergia nigra *from Surinam. The inset map depicts the reclamation of the Zuyder Zee.*

The Nordic Lounge (right) *between two of the main FAO Conference Halls, the Red Room and the Green Room, has been furnished in contemporary style through the combined generosity of Denmark, Finland, Iceland, Norway and Sweden. Elsewhere at FAO Headquarters are many other striking examples of the use of wood in the best modern designs. The buildings themselves which house the Organization were designed and constructed by the Italian Government and are leased to FAO for a nominal rent of $1 per year.*

Fomes annosus

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Fomes annosus *is a serious cause of forest disease in many countries. The severe loss which it can occasion has been known for a long time and its spread now causes great concern. This paper, adapted from a fuller account due to be published shortly, describes the findings of research carried out to date in the United Kingdom in the endeavor to control the further increase of the infection. It does not deal with the treatment of established infections which is also an important current research project.*

The main importance of *Fomes annosus* is as a cause of butt-rot, though it is also responsible for serious losses through windblow, death and reduced volume increment. Most of Britain's forests consist chiefly of first rotation crops, initially free of *Fomes* infection. These contrast strongly with the limited areas where conifers have previously been grown, where the fungus is now generally becoming well-established, and where there is a clear picture of progressive deterioration. For this reason active steps are now being taken to control its further spread and increase.

The mechanism of infection

Newly-cut stumps serve as the principal mode of entry for the fungus. Airborne spores alight on them and grow down into the root systems and thence by root contact or fusion into neighboring standing trees. The most common means of initial infection of a plantation is through stumps created during thinning and, to a lesser extent, during operations such as rack-cutting. [1] Stumps are likewise provided at the time of clear-felling. The regular provision of stumps is probably the main reason why this disease is so much more serious in plantation than in natural forest. Since stumps remain infected for a very long time, frequently for over 40 years, the disease is readily transmitted by carry-over in them from one crop to the next.

The crucial infection factor is thus the upsetting of the normal balance which exists between tree and fungus by thinning and clear-felling operations, and the provision of stumps which are such an ideal mode of entry into the crop. The substrate value of the stump of a tree felled in full vigor, the apparent reduction in the natural resistance of its tissues to fungal growth, and the very numerous root contacts and fusions between trees, provide a combination of factors such that the silvicultural operations might almost have been designed as the best possible way of introducing infection. In addition, stumps usually provide the main sources of sporophores. Infected stumps in the ground lead to the infection of adjoining trees and also of succeeding crops on the same ground, but the presence of such stumps with their associated sporophores has also by the production of spores, a very considerable effect on the rate of development of the disease in all surrounding and neighboring conifer plantations.

[1] Rack-cutting is the cutting of extraction paths.

The fungus is not free-living in the soil, but almost entirely confined to the woody tissues of its host tree or stump. Infection can enter a tree either from infected thinning stumps, from another infected tree or from old infected stumps of a previous crop. Other modes of infection have been noted, through brashing and pruning wounds, through extraction damage to the bole of the tree and to surface roots, through the removal of double leaders and through animal damage to the base of trees, but so far these do not appear to be very important. The most dangerous of them is probably extraction damage, particularly to the roots. There is no evidence whatsoever to confirm the view that infection can enter directly from the soil or that dead roots are a normal mode of entry. Infection has never been found in first-rotation crops before thinning except in a very few cases where some special mode of entry could be traced; for instance the cutting of young stock for Christmas trees, has, on occasion, been the cause of early infection.

Factors in infection and development

Although many factors, such as variations in species reaction, in site factors, in tree health and vigor and in fungal competition, play a part in controlling the level of infection, the overriding limiting factor is the size and availability of the infection sources. By reason of the relatively limited history of past conifer plantings in the United Kingdom, the present level of infection is often low. Increase and build-up infection is measured in decades even under conditions most favorable to the fungus, so that for many years most of the large new areas of coniferous forest would, in the absence of crop protection, be going through the early stages of initial infection and build-up, with relatively little damage to show. Some of the older forest areas on the other hand are now showing the effects of a prolonged period of build-up, and damage is already quite severe in young second rotation crops.

One may expect any conifer plantation, however isolated, to become infected to some degree during the course of a rotation. Isolation never appears to be sufficient to ensure immunity from attack; though the likelihood of early infection occurring and the degree of initial infection is certainly very considerably affected by this factor. On the other hand, where spore sources are nearer to hand, more rapid establishment

of infection occurs and it is in such forests that the position is most immediately dangerous.

Once infection is present in a plantation, a slow spread through root systems gradually takes place and in addition, and this is almost certainly of more importance, the local production of sporophores increases the *Fomes* air spora in the vicinity and thus greatly increases the likelihood of further stump infections following later thinnings. Since spores travel freely for quite long distances the total risk of stump infections in any one plantation is dependant also upon its position in relation to the remainder of the forest. Mutual build-up of infection between plantations is quite as important as the developments in any single one. This factor is one of the main differences between present-day conditions and those of the past. Most of the new conifer areas are in relatively large blocks, where the arrival of infection in any one part will in time considerably affect the position as regards *Fomes* in the remainder. In the past, when small scattered areas of woodland were more usual, isolation effects were considerably greater. Secondly, most of the new forests start off with at least a small area in or near the forest on which conifers have already been planted and where infection sources are thus already established. The conifer plantings of the last century were not usually exposed to infection in this way.

Perhaps the most significant finding in the research work to-date is that rot infection is worse, and usually much worse, in second rotation crops than in first. There is no evidence of rot infection dying out or decreasing in a crop or on a site once it has become established.

Rate of development

It is essential to have the time factor in mind in considering the future behavior of *Fomes*. This fungus is not one of those pathogens the whole development of which occurs in a single season and the incidence of which varies with yearly changes in conditions. *Fomes* is a fungus which, once it enters the tree, stays with it until long after death and continues as part of the birthright of future forest generations. From its initial entry point it only slowly invades the tree and spreads to other surrounding trees. Rates of *Fomes* development vary considerably, and rot attack and build-up normally proceeds much more slowly than in the case of death. On average, some six to ten years elapse between a stump infection and the appearance of fungal stain in the butt of the nearest tree, and the appearance of sporophores, even at a low level of frequency, in most species, is even longer delayed. Thus both spread by growth through the root system and the increase in the local air spora necessary for fresh infections will be very limited for quite a long time after initial infections from an outside source. It will be readily understood that, during the first rotation, *Fomes* often proceeds only as far as the stages of entry and establishment with a limited degree of damage. It is usually only in the second rotation that the attack tends to assume really serious proportions. Where, by lack of thinning, infection does not enter until quite late in the first crop, development is even longer delayed. Thus, although it is possible clearly to follow the trend of development and to get evidence all pointing to the eventual occurrence of widespread and serious levels of attack, the change over short periods of time is often so slight as to go unnoticed.

Killing attack

Although killing attack by *Fomes* is such a striking phenomenon and although in some localities it can do quite severe damage, its importance in the country as a whole is limited. Compared with the problem of butt-rot, that of death gives relatively little concern. The other aspects of *Fomes* attack, namely windblow and loss of increment, are likely in the long-term to prove of greater importance than death. Nevertheless, where death of trees does occur, its effect can be quite severe and the presence of the fungus always has other implications than the killing it causes. Pine is the main species attacked in this way, although most species can occasionally succumb, especially in the first few years after the replanting of an infected site. Even in the case of pine, however, only a small proportion of plantations are at all seriously affected by killing attack and most of those, which are affected, have an alkaline soil reaction or a history of agricultural usage.

Lost increment and windblow caused by root-rot

Fomes is a root-rot fungus and by causing death of roots it is able to affect to a considerable degree their two primary functions, uptake and anchorage, as well as causing the more extreme condition of death of the whole tree. A great deal is not as yet known about the effect of root-rot on increment, but work carried out elsewhere has strongly suggested that such losses can under some circumstances be greater than those caused by butt-rot. Losses due to such a cause can very easily go unnoticed, or be ascribed to site factors rather than the direct effect of long-term loss of roots. It is very easy to remain unaware of a factor so completely hidden as this, and foresters are accustomed to a pathology involving noticeable symptoms. In fact, among all four effects of *Fomes* attack, it is only death, possibly the least important, which is not to some extent hidden.

It is a matter of common observation that blown trees often exhibit rotted roots. Some of the bad blows in North America have been directly ascribed to the effect of root rots. In the United Kingdom, Douglas fir appears to be the species most affected in this way. Even quite young trees have had all their main roots completely rotted. There is often a strong production of fine secondary feeding roots in this species and therefore growth does not appear to suffer. There can be no doubt, however, about the lack of stability of such damaged root systems. It is particularly interesting that Douglas fir, which is relatively resistant to the development of butt-rot, is one of the conifers most subject to root-rot by *Fomes*, with a consequent tendency to windblow.

Windbreak associated with rot has only been found in older trees. Some trees have broken off in the ground at the rotted base, some have snapped at ground level and some have crumpled at a point in the rotted stem. This type of damage may appear more frequently as crops grow older.

The principle of crop protection

The point at which it is easiest to control the development of *Fomes* is at the critical stage of initial entry into the crop. This applies not only to ground carrying its first conifer crop, but also where infection is already established. The newly-cut stump, which provides such an ideal medium for the germination and growth of *Fomes* spores, is in a sense selective, since *Fomes* can colonize some conifer stumps, and especially those of pine, more readily than most other fungi. There are several ways in which this situation may be changed; by providing a complete barrier against all fungi and relying upon the invasion in time by saprophytes from the soil; by using a protectant which is selective, allowing harmless fungi to become established but keeping out the pathogen; or by using a material which alters the substrate value of the stump and alters its selectivity. The whole subject of the fungal ecology of stumps is in its infancy, but it is already known that a number of substances give good protection and that among these creosote, if properly selected and applied, remains the surest. It is likely that in time a change will be made to a chemical or to a mixture of chemicals which, while still providing a surface barrier, also causes more rapid killing of the stump, thus altering its condition rather than tending to preserve its initial state, as creosote does.

FIGURE. *A newly-felled first thinning stump of larch being treated with creosote poured copiously onto the stump from the spouted can then spread by means of the short-handled tar brush. Immediate application and complete coverage should be the aim.*

The practice of protection

Creosote is not a single substance of constant composition but a general term for a product of considerable variability. For stump treatment, as indeed for wood preservation, some creosotes are not nearly so effective as others and care must be taken to avoid those which are unsuitable. A creosote of standard specification or a gasworks creosote of known quality is recommended. Care must always be taken to avoid adulteration. Where poor quality creosote has been used, serious breakdown in protection has been found to occur.

Two other important causes of breakdown have emerged: the use of insufficient quantities and delay in application. It is false economy to make the creosote cover the maximum area. What is wanted is copious application in order to get good penetration. While too much run-off over the bark would be wasteful, some waste is preferable to an over-light application. Care must be taken to avoid missing any bare wood such as axe cuts, and particular care must be taken to cover jagged breaks. Since the creosote only accounts for approximately one fifth of the total cost, the rest being labor, the obvious aim is to do the job as quickly as possible and not to be over-careful with the material. A short-handled tar brush with soft bristles which hold a large volume of material is most suitable. Under easy, level conditions, the open pot and brush method has proved satisfactory but the hilly nature of many forests presents difficulties. The best answer so far found is a one-gallon (4.5 liter) spouted and handled paraffin can as shown in the Figure. The creosote is poured onto the stump and then spread with the brush. The wide base and the small spout considerably reduce the danger of spill. Cans can now be purchased with a polythene spout which is less subject to damage.

Regarding time of application it has been found that, although quite good results may follow treatment the same day as the felling, breakdown sometimes occurs, particularly where resin production from the cut surface interferes with creosote penetration. The possibility of spores being carried some distance into the wood by rainfall is another reason for avoiding delay and in practice the aim must be *immediate application*, delay not being allowed to exceed half an hour at most. The men felling the trees should carry the creosote with them and treat the stumps as they go. This will avoid going over the ground twice and eliminate the difficulty, when a series of trees are felled, of stumps becoming covered with brushwood before they have been treated. A few untreated stumps left covered over with debris can still let infection into a crop, so also may stumps subsequently damaged in extraction operations. Creosote should never be used on wounds of living trees.

Commodity Report

Hardwoods

The market for hardwoods is characterized by a multiplicity of specialized requirements, the wide range of species utilized commercially, and the diversity of qualities they display. Since the war there has been a growing demand for large-sized, good quality hardwood logs, both for the manufacture of veneers and sawnwood and, to meet this demand, there has been a rapid expansion of the use of tropical timbers. Alongside this, there has been in temperate regions a weakened market for medium and low grades of indigenous sawnwood, but an increased demand for small roundwood of broadleaved species. There has been, therefore, a change in emphasis both in the sources of supply for the world trade in hardwoods and in the pattern of consumption.

Production

Most of the wood of broadleaved species removed from the forests in the world as a whole is still used as fuel (Table 1), and far exceeds in volume the output for industrial purposes. Available figures on removals for fuelwood have fluctuated comparatively little over the past decade, probably because they are mostly straight estimates. It is known that actual removals are generally greatly in excess of current estimates.

The rate of expansion in the production of hardwoods for industrial purposes has fallen since 1955. The trend, however, has not been uniform in all the principal producing countries, nor between all categories of roundwood.

The weakening in production has been most marked in Europe, the United States and Australia. But while the output of sawlogs, veneer logs and logs for sleepers has declined, production of pulpwood and pitwood has continued to expand, as has been the case in all regions.

Sawlogs, veneer logs and logs for sleepers

Output of these categories has slowed down in most of the temperate zones but production in the tropics has steadily expanded, in keeping with the dominance these producing areas have achieved in the world market for hardwood logs.

In Europe, output has leveled off since 1955 at about 22.5 million cubic meters, which represents an increase of 35 percent above the output level in 1948. France, the Federal Republic of Germany, Yugoslavia and Romania appear to be the leading producers, with France accounting for more than one quarter of the total. Approximately 40 percent of European output is beech and 20 percent oak. A feature of recent years has been the rapid increase in the proportion of poplar, particularly in southern Europe.

In the United States — largest producer of hardwood logs — output has not followed the pronounced upward trend shown by softwoods since the war. Output was approximately the same in 1955 as in 1948, and in 1957 had dropped by 8.9 million cubic meters to 30.3 million cubic meters. In Canada, too, production has not risen since the war, and the sharp fall in 1957 brought output to the lowest level of the postwar period.

Table 1. – Hardwood Removals

Region	Total				Industrial wood				Fuelwood			
	1948	1954	1955	1956	1948	1954	1955	1956	1948	1954	1955	1956
	in millions of cubic meters (r)											
Europe	115.7	113.8	117.0	117.7	31.9	35.6	38.7	38.9	83.8	78.2	78.3	78.8
U.S.S.R.	57.9	70.1	70.2	70.6	16.8	27.0	27.5	28.6	41.1	43.1	42.7	42.0
North America	101.9	108.9	111.7	111.7	62.0	62.4	65.6	67.3	39.9	46.5	46.1	44.4
Latin America	135.9	141.0	141.0	141.0	14.6	13.9	15.1	15.0	121.3	127.1	126.5	126.0
Africa	88.4	94.7	94.4	98.1	5.2	8.5	9.3	9.6	83.2	86.2	86.1	88.5
Asia[a]	..	..	133.0	132.2	..	..	29.7	26.7	..	..	110.3	105.5
Oceania	12.0	15.0	15.4	15.2	6.0	8.7	9.3	9.1	6.0	6.3	6.1	6.1
World Total	..	..	683.3	686.5	..	..	195.2	195.2	..	..	496.1	491.3

[a] Excludes China

In Soviet Russia, production more than doubled between 1948 and 1955. However, the average annual increase in output of 1.4 million cubic meters during that period fell to 100,000 in 1955-56, to give a production in 1956 of 19 million cubic meters. Soviet Russia has not returned to the position it held earlier in the century of being a major source of supply of hardwood logs for Europe though exports have increased. Production is related to internal demand and there are no appreciable imports.

In tropical countries, the increase in production since the war has been matched by the wider range of species utilized, largely as the result of needs for utility woods, corewoods and utility plywoods. Advances in the field of wood preservation have been partly responsible for the extended range of timber accepted.

By 1956, output from West African countries and the Congo was approximately 5 million cubic meters as against 1.9 million cubic meters in 1948. A similar rapid expansion of output occurred in countries of Southeast Asia which are regular exporters of logs, but the level from which they started after the war was, of course, low. Output seems now to be leveling off or falling owing to marketing difficulties.

Pulpwood and pitprops

As already mentioned, the output of wood of broadleaved species for pulpwood and pitprops has increased throughout the world. But these two categories are combined in the available statistics and the upward trend has probably to be attributed almost entirely to increasing demand for pulpwood, not generally paralleled in the case of pitprops and apparent mostly in Europe and North America.

In Europe, the proportion of small roundwood in the total output of industrial wood of broadleaved species rose between 1948 and 1956 from 10 percent to 18 percent. Similarly, in the United States, output approximately doubled in the same period; in 1957, it increased by a further 69,000 cubic meters to 15 million cubic meters, more than 25 percent of total output of broadleaved industrial wood. In Canada, small roundwood accounted for an even larger proportion of total broadleaved industrial wood — about 40 percent.

In comparison with the northern temperate zone, production of pulpwood and pitprops elsewhere is on a minor scale. In Australia, however, output has been increasing steadily and in 1956 exceeded 1 million cubic meters. The fastest rate of expansion has occurred in Japan. In the Union of South Africa, it has been pitprops for the coal and gold mines which have accounted for the increase in production of small roundwood. The output of 1.2 million cubic meters of pitprops in 1956 was double that of 1936.

Sawnwood

World production of sawn hardwood by regions and major producers is shown in Table 2.

Output in Europe has stabilized around the 1955 level of 10.6 million cubic meters, a rise of only 12 percent from the 1948 output. The chief rise in output has been in the eastern European countries, partly offset by reductions in Western Germany and the United Kingdom. France, the other major European producer, profited by the lack of exports from those eastern European countries which were prewar exporters to increase its share of the European market for sawn hardwoods. In the United States and Canada, economic recession brought 1957 output well below earlier postwar levels. The average annual increase in the U.S.S.R. over the period 1948-55 was 920,000 cubic meters, but this fell to 150,000 cubic meters in 1956 and 360,000 cubic meters in 1957.

A general trend in recent years has been for timber producing countries that rely on an export trade to cut their logs themselves and export lumber. This is reflected in the extensive construction of new sawmills and the modernization of existing mills in many tropical countries. Production of sawn hardwood in such coun-

TABLE 2. – PRODUCTION OF SAWN HARDWOOD

Region	1948	1954	1955	1956	1957
	... *in thousands of cubic meters (s)* ...				
Europe	*8 820*	*9 820*	*10 600*	*10 610*	*10 640*
Germany, Federal Republic	1 738	1 202	1 413	1 436	1 350
France	1 800	2 276	2 355	2 480	2 300
Italy	671	882	966	946	939
Poland	236	554	616	596	680
Romania	209	620	667	724	794
United Kingdom	*1 550	950	995	850	861
Yugoslavia	208	428	504	515	535
*U.S.S.R.**	*4 900*	*10 350*	*11 340*	*11 490*	*11 850*
North America	*18 850*	*17 800*	*18 680*	*18 640*	*14 790*
Canada	1 387	1 102	966	992	872
United States	17 464	16 695	17 714	17 646	13 917
Latin America	*3 950*	*4 210*	*4 010*	*4 060*	
Brazil	7 991	889	713	731	657
Colombia	*920	880	*925		
Africa	*640*	*1 300*	*1 290*	*1 340*	
Belgian Congo	137	280	250	321	321
French Cameroons	33	75	74	77	
French Equatorial Africa	51	69	73	81	
French West Africa	44	74	80	88	
Ghana	91	271	*280		
Nigeria	24	*40	*50	*60	
Asia	*4 930*	*7 680*	*8 610*	*9 840*	
China	*130	*380	*400		
India	418	583	*610		
Indonesia	*484	1 125	1 096	1 178	
Japan	540	1 642	2 202	3 247	
Malaya	*350	789	940	743	
Philippines	1 128	765	740	1 078	
Thailand	702	948	950	881	940
Oceania	*2 120*	*2 720*	*2 790*	*2 600*	
Australia	2 017	2 591	2 637	2 451	
WORLD TOTAL	*44 210*	*53 880*	*57 320*	*58 580*	

* Estimated

tries has therefore tended to expand, in contrast to the general situation in the temperate zone. In Africa, the increase in production of sawnwood has not yet matched the growing output of logs for which there is a big export demand. In Asia, sawnwood production has fluctuated owing to a number of variable factors which make it difficult to say whether production is really on the upgrade. There has certainly been an expansion in Japan: production in 1956 of 3.25 million cubic meters was more than double the 1954 output and brought Japan to the position of third largest producer of sawn hardwoods.

Trade

World trade in wood of broadleaved species has altered in pattern during the postwar period. North American hardwood exports have very largely disappeared from markets outside the dollar area, notably from their traditional markets in Europe and South America. They have been replaced partly by exports from Japan but to a much greater extent, by tropical timbers from Africa, Asia and to a lesser degree from South and Central America.

In Europe, the trend towards rationalization has led to a greater degree of manufacture in the producing countries, many of which have imposed restrictions on the export of logs. At the same time the need to maintain the supply of logs to the established milling industries in the importing countries of western Europe has resulted in increased demand from tropical sources, especially over the last four years. Between 1953 and 1956 the imports of tropical timber in the round by Germany rose from 550,000 to 1 million cubic meters, imports by France from 173,000 to 378,000 cubic meters, and by Italy from 43,000 to 148,000 cubic meters. During the same period, however, imports of logs of tropical timber into the United Kingdom declined from 496,000 to 287,000 cubic meters, while the imports of tropical sawnwood increased from 330,000 to 418,000 cubic meters.

In 1956, tropical timbers accounted for 76 percent of the total imports of hardwood logs by European countries, and 39 percent of the total imports of sawn hardwoods. Of temperate species, oak accounted for 6.4 percent of the trade in logs and 17 percent of the trade in sawnwood. The corresponding figures for beech were 8.3 percent and 28 percent. Beech remained the most important single species traded by European countries. The trade in beech and oak is largely intra-regional, France being the major exporter of logs, and Yugoslavia, Romania and France the main exporters of sawnwood.

Both imports and exports in Europe reached a peak in 1955 (Table 3, page 186). The general decline in volume of trade in 1956, most marked in the United Kingdom, was partly attributable to the generally reduced tempo of industrial expansion in Europe, notably in the building trade and furniture industry, partly too by tight money policies which curtailed the availability of credit. Very largely, however, trading in 1956 was affected by the shipping confusion caused by the closure of the Suez Canal.

In 1957, despite higher freight rates and the absence of any pronounced increase in the tempo of industrial activity, there was a general strengthening of trade with an increase once again in the volume of imports into Europe of tropical timbers. Stock replacement and a relaxation of credit restrictions in some cases may have contributed to this revival.

There is fairly substantial trade in hardwood logs and lumber between the United States and Canada. Exports to the rest of the world from North America have been conditioned by high prices and sustained internal demand, combined with shortages of dollars in importing countries and high freight rates. In recent months, the reduction in demand in the United States and the removal of restrictions on United Kingdom imports have encouraged United States shippers to renew their efforts to place exports abroad.

As is the case in Europe, the greater part of United States imports are of tropical timbers, sawnwood and roundwood from West Africa, the Philippines and Central and South America. A substantial volume of sawnwood is imported from Japan. The uneven movement of these imports is shown in Table 3. African exports of logs to the United States in 1957, mostly mahogany, dropped by 42 percent from 1956 and lumber fell by 60 percent to 17,000 cubic meters.

The predominant species exported from Africa to all destinations in 1956 were: okoumé, 777,000 cubic meters (French Equatorial Africa); obeche, 485,000 cubic meters (Ghana, Nigeria, French West Africa); mahoganies, 270,000 cubic meters (Ghana, Nigeria, French West Africa, French Cameroons); limba, 215,000 cubic meters (Belgian Congo, French Equatorial Africa); and sapele, 158,000 cubic meters (Ghana, Nigeria). Other species exported in quantity were makoré, abura, utile, agba, azobé (mainly for sleepers) and ilomba.

Japan's imports of logs in 1956 were approximately three times as large as those of any other country, and were mainly in the form of luan for the expanding plywood and lumber industries; 234,000 cubic meters of logs came from North Borneo. Hong Kong, as a transit port, and Australia have become heavy importers of logs from Sarawak and North Borneo, and Singapore, another transit port, absorbs the bulk of the log exports from Indonesia.

Asian exports to Europe are mostly in the form of sawnwood. In 1956, the most important species were keruing and meranti from Malaya, ramin and meranti from Sarawak, seraya and keruing from North Borneo and teak from Burma and Thailand. Of these, ramin has rapidly become one of the most important of the tropical timbers used in Europe. Japan exports quantities of sawnwood — mainly oak and beech — both to the United Kingdom and the United States; trade was sharply affected in 1957 by the recession in the United States and the reluctance of United Kingdom importers to accept the available timber grades at the prevailing freight rates.

TABLE 3. – IMPORT AND EXPORT MOVEMENTS IN SAWN HARDWOOD AND HARDWOOD LOGS, 1948-1957

Exports

Country	Sawn hardwood					Hardwood loss				
	1948	1954	1955	1956	1957	1948	1954	1955	1956	1957
	in thousands of cubic meters (r)									
France	104	266	419	262	223	130	482	712	428	386
Romania	39	194	176	206	226	—	—	—	—	—
Yugoslavia	194	302	268	213	339	56	2.7	0.5	0.5	—
Canada	472	272	353	320	275	113	97	112	112	95
United States	207	185	276	287	294	140	153	103	151	149
Brazil	48	22	38	20	68	109	56	62	44	27
Belgian Congo	27	30	30	43	51	60	166	161	132	120
French Cameroons	14	25	25	30	..	68	77	95	100	..
French Equatorial Africa	13	23	23	24	..	296	741	946	974	..
Ghana	24	147	182	206	..	177	354	479	555	..
Nigeria	15	36	43	49	..	91	290	411	328	..
British North Borneo	5.0	56	19	19	31	89	355	451	542	749
Indonesia	—	16	14	15	..	17	168	186	219	..
Japan	17	219	323	281	..	—	0.5	0.3	—	..
Malaya	48	146	202	229	..	1.9	0.4	—	0.1	..
Philippines	54	132	121	136	..	45	1 353	1 565	1 943	..
Sarawak	14	152	176	143	161	21	156	151	137	139

Imports

	in thousands of cubic meters (s)									
Belgium-Luxembourg	60	79	116	92	99	80	177	247	251	255
Germany, Federal Republic	..	84	194	168	167	—	614	865	871	939
France	36	24	24	28	41	162	318	406	383	460
Italy	62	161	156	166	206	16	108	190	214	305
Netherlands	87	125	133	124	139	194	210	227	221	216
United Kingdom	551	714	844	702	762	452	327	436	332	383
Canada	56	179	238	272	229	—	—	—	—	—
United States	512	492	628	645	585	462	420	541	546	412
Argentina	76	186	162	..	..	276	224	262	286	..
Egypt	..	165	177	108	125	..	2.6	0.4	4.1	1.9
Union of South Africa	203	167	208	199	188	..	..	..	..	..
Japan	—	1.7	5.9	6	..	12	1 491	1 864	2 331	..

TABLE 4. – CONSUMPTION OF SAWN HARDWOOD

Country		1948	1954	1955	1956	1957
		in thousands of cubic meters				
Europe	Imports	*950*	*1 400*	*1 780*	*1 606*	*1 743*
	Exports	*600*	*1 040*	*1 180*	*965*	*1 088*
	Net Trade	*+ 350*	*+ 360*	*+ 600*	*+ 641*	*+ 655*
	Production	*8 820*	*9 820*	*10 600*	*10 610*	*10 640*
	Consumption	*9 170*	*10 180*	*11 200*	*11 251*	*11 295*
Germany, Federal Republic	Imports	..	84	194	168	167
	Exports	100*	102	62	59	69
	Net Trade		– 18	+ 132	+ 109	+ 98
	Production	1 738	1 202	1 413	1 436	1 350
	Consumption		1 194	1 545	1 545	1 448
France	Imports	36	24	24	28	41
	Exports	104	266	419	262	223
	Net Trade	– 68	– 242	– 395	– 234	– 182
	Production	1 800	2 276	2 355	2 480	2 300
	Consumption	1 732	2 034	1 960	2 246	2 118
Italy	Imports	62	161	156	166	206
	Exports	8	2.0	52	2.9	3.6
	Net Trade	+ 54	+ 159	+ 104	+ 163	+ 202
	Production	671	882	966	946	939
	Consumption	725	1 041	1 070	1 109	1 141
Poland	Imports	12	1.6	4	3	3
	Exports	1.1	10	11	11	8
	Net Trade	+ 11	– 8	– 7	– 8	– 5
	Production	236	554	616	596	680
	Consumption	247	546	609	588	675
Romania	Imports	—	—	—	—	—
	Exports	39	194	176	206	226
	Net Trade	– 39	– 194	– 176	– 206	– 226
	Production	209	620	667	724	794
	Consumption	170	426	491	518	568
United Kingdom	Imports	551	714	844	702	762
	Exports	2.1	7.2	6.0	8.4	7.4
	Net Trade	+ 549	+ 707	+ 838	+ 694	+ 755
	Production	1 550*	950	995	850	861
	Consumption	2 099	1 657	1 833	1 544	1 616
Soviet Russia	Imports	*21*	*132*	*74*	*145*	..
	Exports	*69*	*3.6*	*10*	*2.5*	..
	Net Trade	*– 48*	*+ 128*	*+ 64*	*+ 142*	..
	Production	*4 900**	*10 350**	*11 340**	*11 490**	*11 850**
	Consumption	*4 852*	*10 478*	*11 404*	*11 632*	..

* Estimated.

TABLE 4 - CONSUMPTION OF SAWN HARDWOOD (*continued*)

Country		1948	1954	1955	1956	1957
		..... *in thousands of cubic meters*				
North America	Imports	*570*	*670*	*870*	*918*	*814*
	Exports	*680*	*460*	*630*	*606*	*569*
	Net Trade	*– 110*	*+ 210*	*+ 240*	*+ 312*	*+ 245*
	Production	*18 850*	*17 800*	*18 680*	*18 640*	*14 790*
	Consumption	*18 740*	*18 010*	*18 920*	*18 952*	*15 035*
Canada	Imports	56	179	238	272	229
	Exports	472	272	353	320	275
	Net Trade	– 416	– 93	– 115	– 48	– 46
	Production	1 387	1 102	966	992	872
	Consumption	971	1 009	851	944	826
United States	Imports	512	492	628	645	585
	Exports	207	185	276	287	294
	Net Trade	+ 305	+ 307	+ 352	+ 358	+ 291
	Production	17 464	16 695	17 714	17 646	13 917
	Consumption	17 769	17 002	18 066	18 004	14 208
Latin America	Imports	*120*	*205*	*200*	*209*	..
	Exports	*220*	*240*	*280*	*269*	..
	Net Trade	*– 100*	*– 35*	*– 80*	*– 60*	..
	Production	*3 950*	*4 210*	*4 010*	*4 060*	
	Consumption	*3 850*	*4 175*	*3 930*	*4 000*	..
Argentina	Imports	76	186	162	..	..
	Exports	—	—	—	—	..
	Net Trade	+ 76	+ 186	+ 162		
	Production	470	570	584	..	..
	Consumption	546	756	746	..	..
Brazil	Imports	—	1.0	—	—	—
	Exports	48	22	38	20	68
	Net Trade	– 48	– 21	– 38	– 20	– 68
	Production	799	889	713	731	657
	Consumption	751	868	675	711	589
Colombia	Imports	—	—	0.7	—	—
	Exports	—	6.7	4.3	111	20
	Net Trade	—	– 6.7	– 3.6	– 11	– 20
	Production	920*	880	926*	..	..
	Consumption	920*	873	921	..	..
Africa	Imports	*240*	*470*	*460*	*414*	..
	Exports	*130*	*300*	*350*	*404*	..
	Net Trade	*+ 110*	*+ 170*	*+ 110*	*+ 10*	..
	Production	*640*	*1 300*	*1 290*	*1 340*	..
	Consumption	*750*	*1 470*	*1 400*	*1 350*	..

* Estimated.

TABLE 4 - CONSUMPTION OF SAWN HARDWOOD (*concluded*)

Country		1948	1954	1955	1956	1957
		..... *in thousands of cubic meters*				
Union of South Africa	Imports	203	167	208	199	188
	Exports	5	13	14	20	23
	Net Trade	+ 198	+ 154	+ 194	+ 179	+ 165
	Production	20	33	35	..	..
	Consumption	218	187	229	..	..
Asia	Imports	*200*	*230*	*240*	*170*	..
	Exports	*410*	*890*	*1 090*	*1 096*	..
	Net Trade	*– 210*	*– 660*	*– 850*	*– 926*	..
	Production	*4 930*	*7 680*	*8 610*	*9 840*	..
	Consumption	*4 720*	*7 020*	*7 760*	*8 914*	..
India	Imports	142	49	43	26	..
	Exports	—	—	—	—	
	Net Trade	+ 142	+ 49	+ 43	+ 26	..
	Production	418	583	610*	..	..
	Consumption	560	632	653	..	
Indonesia	Imports	8.1	0.3	2.6	4.0	..
	Exports	—	16	14	15	..
	Net Trade	+ 8.1	– 15.7	– 11.4	– 11	
	Production	484*	1 125	1 096	1 178	..
	Consumption	492	1 109	1 085	1 167	
Japan	Imports	—	1.7	5.9	6	..
	Exports	17	219	323	281	..
	Net Trade	– 17	– 217	– 317	– 275	
	Production	540	1 642	2 202	3 247	..
	Consumption	523	1 425	1 885	2 972	
Philippines	Imports	—	—	—	0.1	
	Exports	54	132	121	136	..
	Net Trade	– 54	– 132	– 121	– 136	
	Production	1 128	765	740	1 078	
	Consumption	1 074	633	619	942	
Oceania	Imports	*30*	*80*	*130*	*147*	..
	Exports	*40*	*40*	*40*	*40*	..
	Net Trade	*– 10*	*+ 40*	*+ 90*	*+ 107*	..
	Production	*2 120*	*2 720*	*2 790*	*2 600*	..
	Consumption	*2 110*	*2 760*	*2 880*	*2 707*	..
Australia	Imports	6.8	51	100	105	108
	Exports	42	37	44	39	42
	Net Trade	– 35	+ 14	+ 56	+ 66	+ 66
	Production	2 017	2 591	2 637	2 451	2 328
	Consumption	1 982	2 605	2 693	2 517	2 394
WORLD TOTAL	Imports	*2 130*	*3 190*	*3 750*	*3 610*	..
	Exports	*2 150*	*2 970*	*3 580*	*3 380*	..
	Net Trade	*– 20*	*+ 220*	*+ 170*	*+ 230*	
	Production	*44 210*	*53 880*	*57 320*	*58 580*	
	Consumption	*44 190*	*54 100*	*57 490*	*58 810*	

* Estimated.

In contrast to the world trade in softwoods, the market for hardwoods has been characterized by the expansion of the trade in logs at a rate exceeding that in sawnwood. Shipments of logs constitute now roughly two thirds of total world trade in wood of broadleaved species; in 1948 they formed only one half. This is a measure of the concentrated requirements of established milling capacity in Europe, North America and Japan. The growth of milling and manufacturing industries in the tropical producing countries, in conjunction with high freight rates, may presage a greater expansion of the trade in processed wood.

Consumption

Consumption of sawn hardwoods has tended to level off since 1955 (see Table 4). Hardwood lumber being consumed largely in housing construction and in the furniture industry, the reduction in building programs in Europe and North America has been partly responsible for the weaker demand. At the same time, reduced economic activity led to a fall in demand for furniture which was accentuated in certain countries — for example, the United Kingdom — by credit restrictions aimed at curtailing the purchase of the range of consumer goods which includes furniture. The upswing in housing construction in the United States in the first half of 1958 has already been reflected in an improved demand for oak and maple flooring. Similarly the easing of the tight money policy in the United Kingdom may be expected to lead to improved demand from the building and furniture trades.

On the longer term basis, the continued use of sawnwood in buildings and furniture is threatened by competition from substitute materials on an increasing scale. Some of these replace wood altogether; others — for example plywood, fibreboard and particle board — substitute wood-derived products for solid timber. The cumulative effect is to shift the emphasis of hardwoods output from sawlogs to veneer logs and, to a much lesser extent, to the grades utilized in the manufacture of the various modified-wood products.

Plywood is at present the most important of the substitute wood products. In the postwar period, European plywood production expanded rapidly — from 875,000 cubic meters in 1948 to 2.5 million cubic meters in 1956 (see *Unasylva* Volume 12, Number 2). Roughly 90 percent of this output was manufactured from broadleaved species. Hardwoods also form the main raw material for plywood in the tropics and in Japan, where the rate of expansion has been even faster than in Europe.

Consumption of small roundwood has increased due to the growing use for pulp. The current total consumption of pulpwood of broadleaved species in Europe is estimated at 5.8 million cubic meters. In the United States, consumption was 6 million cubic meters in 1956, an increase of 429,000 cubic meters over 1955, and representing 17 percent of total pulpwood consumption. In the Lakes States region, consumption of hardwoods for pulp already equals that of coniferous species, and encouraging progress with the chemi-groundwood process of pulping seems to promise more intensive utilization of broadleaved species in the future.

Additional demand for small roundwood is created in the manufacture of the modified-wood products, although the total is not great. Production of fibreboards and particle boards is concentrated mainly in North America and Europe. The proportion of hardwoods used varies with the process, and the manufacture of particle board is largely based on the use of wood residues The rate of expansion of output of the board-manufacturing industries is exceptionally high, and the future consumption of broadleaved species in these processes will probably be appreciable even if it accounts for a no greater proportion of the total than at present. It is clear that the demand for small roundwood will be a major factor in the future level of utilization of the wood of broadleaved species.

Prices

The diversity of specifications in the hardwood trade, and the absence of any generally applied standards of grading, complicate comparisons between prices.

Table 5 shows average comparative prices on the French and United Kingdom markets for sawn oak, beech and mahogany and mahogany logs, with 1949 as a base. The steady rise in the prices of sawnwood contrasts with the comparatively low over-all increase in the price of logs, after a steep initial rise in the early 1950's, although the use of average figures obscures the fact that high grade roundwood, for veneers and high quality sawnwood, has exhibited a sharp increase in price. Higher sawnwood prices reflect rising production costs, and it is also possible that better grading, by improving the actual quality of the grades, has contributed.

Table 5. – Comparative Prices of Hardwood Categories (1949 = 100)

Year	U.K. imports (c.i.f.)				French imports	
	Sawnwood			Logs, mahogany	Logs, mahogany (imports c.i.f.)	Sawn oak (f.o.b.)
	Beech	Oak	Mahogany			
1949	100	100	100	100	100	100
1951	144	137	129	156	—	—
1953	139	137	113	135	135	205
1955	146	173	124	125	120	222
1957	145	173	143	109	120	238

An important factor affecting hardwood prices has been the development of freight rates. Appreciable increases were registered in 1956 by nearly all the shipping " conferences ". Trade between Europe and the Asia-Pacific area was most affected, following a 15 percent rise in freight rates in September 1956 and a further

15 percent rise added following the closure of the Suez Canal. Though the surcharge on Far East freight rates was reduced to 5 percent in May 1957, freight rates in general continued to rise. The upward trend was broken early in 1958 by reductions by the West African Lines Conference. The spate of cuts which followed had the aspect of a freight war, and the ensuing uncertainty has dampened the market. When stability is renewed at lower levels, trade between Europe and the tropical producers may be expected to pick up, and North American shippers may re-enter the European market.

Summary

The position of tropical species in world markets is now well established. Their size and quality make them suitable for many of the uses to which hardwoods are put, and advances in technology will continue to increase the range of tropical timbers which can be made available and used.

A consequence has been a weakened demand for the medium and low-grade hardwoods which form a large part of the output from broadleaved forests in Europe. The maintenance in the forest of a broadleaved component is claimed to be essential over much of Europe for silvicultural and edaphic reasons, to maintain the condition of the soil and the stands. It is, therefore, a matter of considerable concern that markets be found for the full range of sizes and grades of broadleaved species to ensure that what is silviculturally necessary is also economically productive.

In the past ten years, in the temperate zone, a shift in the pattern of hardwoods consumption has occurred from sawlogs to veneer logs and pulpwood. In the manufacture of pulp, plywood and the modified wood products which are increasingly gaining ground as substitutes for solid wood, an extensive and expanding outlet is appearing for hardwoods, in particular the small and low-grade roundwood of which there is at present a chronic surplus in Europe and, to a lesser extent, in North America. Within the limits imposed by the economics of harvesting, processing and transport, it is in these categories that the major increases in the future use of hardwoods is likely to occur.

INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE

During the last 10 years that the International Union for the Conservation of Nature (IUCN) has existed, there has been a noticeable and favorable change in the attitudes of governments and other agencies to what should be done to save and develop natural resources. The last assembly of IUCN held at Athens from 11 to 19 September and attended by delegates from 46 countries, illustrated the present much wider approach and brought international expert opinion to bear towards the wiser use of the land and waters of the world.

The special themes for discussion were the conservation of soil and water, and education in conservation, both subjects of fundamental concern to FAO. In regard to the first of these, discussion centered mostly on the influence of different kinds of vegetation in holding the soil in place and on water control. Attention was also given to the effect of large-scale dams on preventing the migrations of fish; they also, however, provided opportunities to create large sources of protein food in parts of the world where this is most needed.

There does exist, of course, a difference of viewpoint between those who wish to base the future use of land on history and to avoid the loss of that beauty associated with traditional patterns of land use, and those who would break entirely with the past to meet the changing needs of an industrial age. The basic need is to maintain and improve the productive capacity of soil and water. "If it pays to conserve soil, soil is conserved. If it pays to exhaust the soil, soil is exhausted." This is the fact of present-day conditions.

Education in conservation is above all required in underdeveloped areas where an uncontrolled growth of population may cause irreversible damage to natural resources through overexploitation. Education must be aimed, first, at the indigenous populations who must by some means be brought to have a feeling of personal responsibility for their land; secondly, at the industrialist who is tempted to take advantage of the present to the detriment of the future; and, thirdly, at the administrators whose functions include maintaining a proper balance between preservation and exploitation.

The International Union has in the past been substantially helped by UNESCO. Governments and private agencies are giving it increasing support. But its continued financing on an expanded basis and also its exact relationship with FAO remain to be decided.

The Work of FAO

Protection of Wood against Marine Borers

A report to the Government of India has recently been issued by Professor G. Becker engaged by FAO to advise on the protection of wood against the attack of marine borers and to demonstrate at the Forest Research Institute, Dehra Dun, the latest developments in research and control.

Deterioration of wood in sea water is caused by two groups of marine organisms; molluscs and crustaceans.

FIGURES 1 and 2. – *The shells cover only the foremost half of the body of the Teredinidae, and work as wood-boring apparatus.*

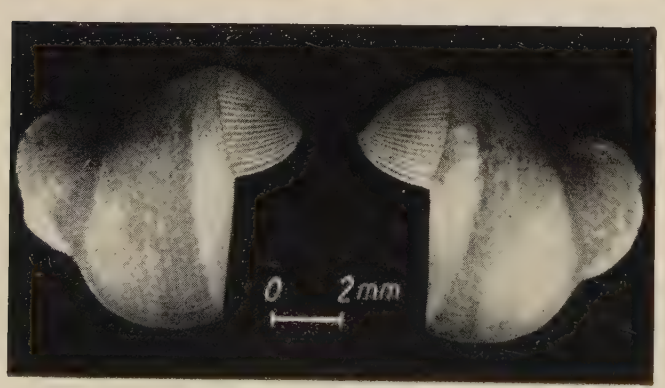
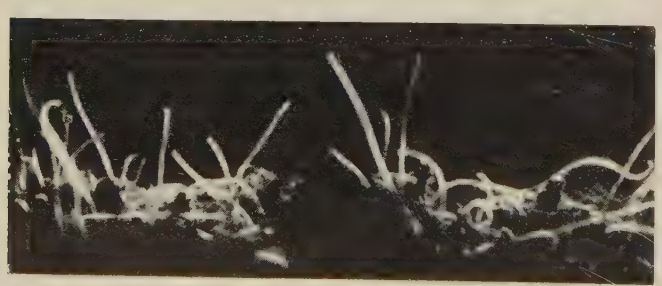


FIGURE 3. – *Two siphons ingest and egest the sea water.*

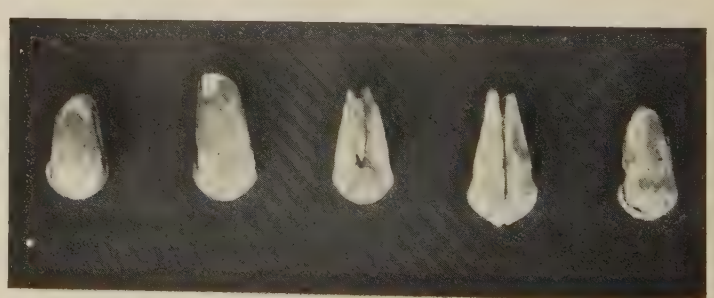


The molluscs belong to the genera *Teredo*, *Bankia* and *Nausitora* of the Teredinidae family, and the genera *Martesia* and *Pholas* of the Pholadidae family. Of crustaceans the most important genera, *Limnoria and Sphaeroma, are* Isopoda; the genera *Chelura*, *Metaponorthus* and others belonging to different crustaceae families are of minor importance.

Teredinidae got their name " shipworms " from the long bodies of the adults. Some species grow to 1 meter. The shells cover only the foremost part of the body (Figures 1 and 2) and work as a rasping and boring apparatus to grind the wood. The boring tunnel with the calcareous coating of its inner surface protects the stretched, soft-skinned body. Two siphons ingest and egest the sea water (Figure 3). These siphons can be retracted and closed firmly by means of two calcareous appendages to the body, the so-called pallets. In this state, shipworms are able to survive in spite of removal from sea water or in water of a very low salinity for a period of days to weeks. Propagation of shipworms takes place by freely swimming larvae. Some of the species ejaculate eggs and sperm into

FIGURE 4. – *Characteristic long boring tunnel of Teredinidae.*

FIGURE 5. *Bivalve shape of* Martesia *genus of Pholadidae.*



the water, of others the larvae develop in the interior of the females, so that the swarming period of the larvae is shortened. The deterioration pattern of Teredinidae is characterized by the long boring tunnel which looks circular in cross section and often runs parallel to the wood fibers (Figure 4).

The shape of Pholadidae is more like a common bivalve; this is especially true for the *Martesia* genus, which is very important in tropical waters (Figure 5). These " piddocs " are not fixed on to the wood. The holes they make within the timber correspond to the length of their bodies. The pointed back end with its short siphons extends somewhat out of the tunnel. Martesia grows to a length of about 4 centimeters. Pholadidae also propagate by freely swimming larvae. Though the tunnels — compared with those of Teredinidae — are relatively short (Figure 6), they cause considerable damage; for the deterioration proceeds deeper into the wood from one generation to another.

Limnoria, the so-called " gribble," belonging to Isopoda, is 3 to 5 millimeters in length, flat and unpretentious, and able to roll itself together like a terrestric isoped (Figure 7). The gribbles can leave their tunnels at random, swim about and select new breeding places. Newly infested timber is mostly attacked by young and middle-sized organisms with a peak at certain seasons. *Limnoria* eats its tunnels quite close to the surface of the wood (Figure 8). Though small in size it completely deteriorates the wood (Figure 9), but takes longer, of course, than the shipworm.

The species of the Sphaeroma genus (" pill bugs ") are considerably longer. They grow up to 10 millimeters; their shape is more rounded than that of *Limnoria*. They, too, are able to roll themselves together like other isopods. They are also able to leave their tunnels, creep about on the surface of the wood and swim. Their boring tunnels are never less than twice the length of their bodies but, when occurring densely, they cause serious damage (Figure 10).

All other wood-inhabiting crustaceans are of minor economic importance.

FIGURE 6. – *The boring tunnels of Pholadidae. Relatively short compared with those of the Teredinidae, they cause considerable damage.*

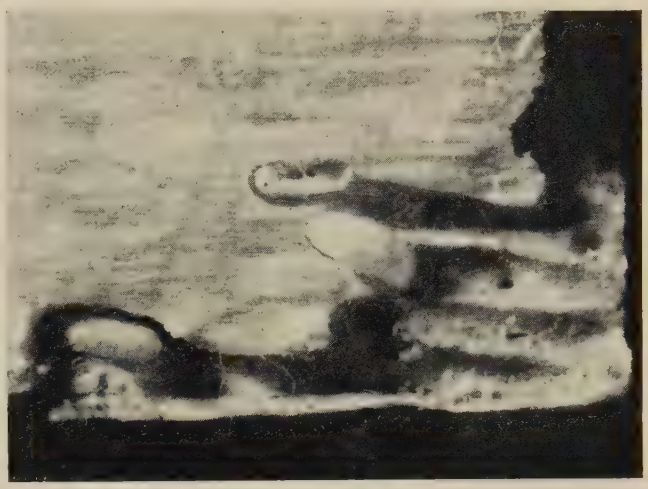


FIGURE 7. – *The* Limnoria, *which is able to roll itself together like a terrestric isoped.*

FIGURE 8. – Limnoria *boring tunnels are close to the wood surface.*

FIGURE 9. – *Wood deterioration by* Limnoria *is complete.*

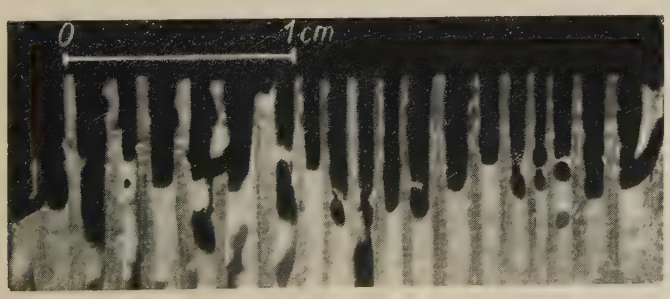


FIGURE 10. – *Dense occurrence of* Limnoria *boring tunnels, cause serious damage.*

The Amazon

The FAO officer (Mr. V. Hasek), in charge of the sawmilling training center at Santarem on the Brazilian Amazon, has sent the photograph shown on this page.

At the logging demonstration center at Curua Camp on the Curua tributary of the Amazon, roads have been constructed with mechanized equipment brought in and maintained with some difficulties. Repair of machinery takes a large amount of time and occasionally strong language. The first few compartments have been felled in accordance with prescribed methods. Some of the logs are being cut on a portable sawmill in the forest for use in construction of living quarters which will be somewhat more permanent than the present tents and thatch-covered frames. But

A wing of the school building at the sawmilling center at Santarem, which includes a dormitory, dining room and kitchens.

most logs will be hauled to the river to the loading-dock being constructed, for transport to the sawmill at Santarem.

Communications, food supply, and transport of tools, parts, and personnel between Curua Camp and Santarem are dependent on a motorboat and steam launch. The motorboat takes about four hours from Santarem to Curua, and about five or six hours against the Amazon current for the return trip. The slower launch requires about 10 hours and 12 hours for the same trips. The technical assistance team must therefore not only be expert in logging, silviculture, and sawmilling, but also in marine motors and navigation, and must possess, as they do, an abundance of patience in dealing with balky motors, water in the petrol, and shifting river channels, not to mention mosquitoes, humid heat, and difficulty in obtaining drinking water, and fresh food.

A vegetable garden is maintained in wooden boxes on stilts at the logging camp. The camp cook is particularly efficient in catching fish, including the edible varieties of the flesh-eating *piranha*, and also in preparing these fish, and the fowl and animals brought in from hunting in the forest. This is a particularly important factor in keeping up the morale and spirits of the road and logging crews.

The other forestry members of the FAO Amazon mission are Mr. G. G. Gray who heads the team, Mr. C. J. Pitt as silviculturist, Mr. B. B. Glerum in charge of forest inventory operations, and Mr. W. O. Hopf, logging instructor. Mr. D. Heinsdjik, who initiated the extensive inventory work carried out over selected areas, has been transferred to Rio de Janeiro to help to organize a federal forest inventory service.

A center for training Indian boys in forestry work has been started at Aychapichu, located 45 kilometers to the south of Quito at an altitude of 3,000 meters. This is a very modest establishment but the history of its origin is highly significant and interesting and deserves to be put on record.

There is a semiautonomous charitable organization working under the Ministry of Social Welfare which is called the *Asistencia Pública* and owns *haciendas* (landed estates) out of the profits of which hospitals, orphanages and old people's homes are maintained. It also runs shops to issue some consumer goods and drugs to poor people at cheap prices.

This organization owns the particular *hacienda* where the forestry training centre is located. The administration of the organization was persuaded by the forestry technical assistance officer in Ecuador, Mr. Gonzalez de Moya, with the help of the then Director of Forests, who was acting as his counterpart, to start a center for the establishment of a forest nursery. This did not succeed for lack of wholetime skilled labor to attend to the work. It was then suggested that some Indian boys, mainly orphans recruited from the Oriente area from missionary societies, be trained here in forestry work. This is how the idea grew.

There are now six boys under training for nine months. They stay at the center and, although the feeding and lodging arrangements are primitive, great credit goes to the organizers for building up this potentially valuable institution from very humble beginnings.

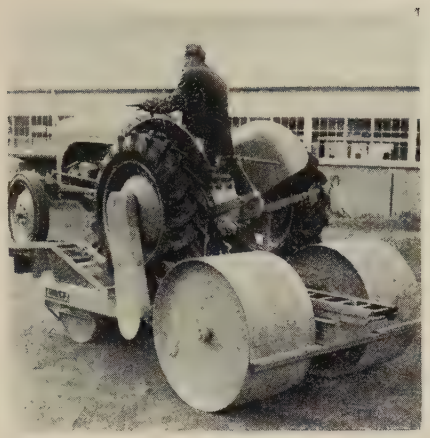
The boys had already received elementary education from the missionary societies. At the center they have been receiving lectures and practical training in elementary forestry subjects as well as in civics, mathematics and geography. They are all likely to find employment in the Government's Forestry Department.

This is attracting the attention of responsible authorities among the public and in the Government. What is particularly satisfying is the fact that this work did not fall strictly within the terms of reference of the FAO forestry officer. He now hopes that the program can eventually be developed into a properly established forestry training institution for Ecuador. For this purpose it is proposed to shift the center to some land belonging to the Forestry Department nearer Quito.

Equipment Section

GRUBBER BLADE. — For the International BTD-6 crawler tractor, attachment uses same arms and controls as Skid-Shovel; has same 4-point hook-up, substituted in a few minutes. 5 curved teeth 34 in. (86 cm.) long, mounted on heavy frame 67½ in. (171 cm.) wide. Teeth of manganese molybdenum steel, individually mounted and adjustable for spacing. Penetration 16 in. (41 cm.). Blade removes stumps, whole trees, boulders and stones. Pitched forward, teeth perform raking action; pitched backwards, blade carries objects after removal for piling or loading. All operations controlled from tractor seat.

International Harvester Company of Great Britain Limited, City Road, London E.C.1., England.

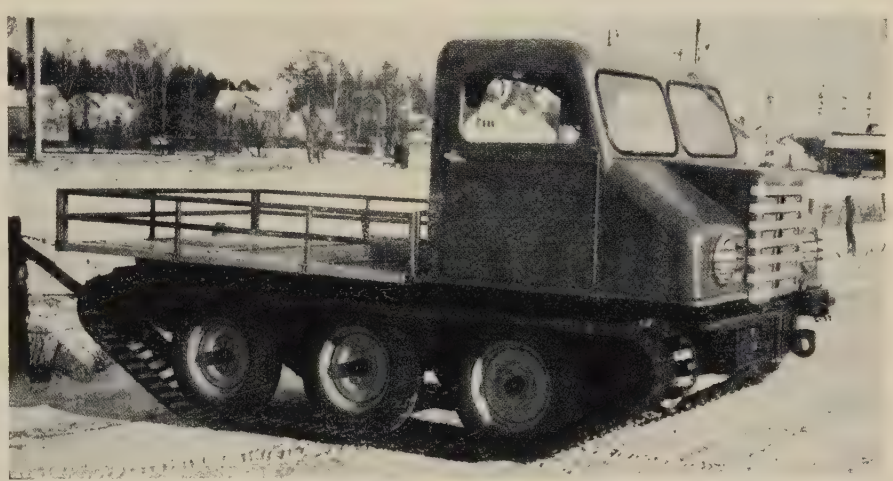


"TRACTAMOUNT" ROLLERS. — Converts 4-wheeled tractors into road rollers in few minutes. Tractor can readily be made available for other work. For all models there is water tank assembly for keeping 3 rollers wet for tar macadam work, etc. Models available: for Fordson Major, total weight up to 8¼ long tons; for Ferguson, standard model: 3 to 5 tons; heavy model: 5 to 8 tons. Spring-loaded scrapers fitted to all rollers. An arrangement by which the roller can be towed available as extra.

E.V. Twose (Manufacturing) Ltd., Lowman Works, Tiverton, Devon, U.K.

NORDVERK TRACTOR. — Designed for use on all ground and in all seasons. *Specifications*: length: 4.2 m.; width: 1.78 m.; height: 2.22 m.; platform body: 1.7 × 2.4 m.; loading capacity: 1,200 kg.; service weight: 2,500 kg.; top speed: 55 km/h. Tow hook in front as well as behind; motor: Volvo ED 90 hp, petrol; gear box: 4-speed gear and 1 back. Each track-side consists of 2 wire-armored rubber tracks with steel links fastened with bolts. Total track width 50 cm.; smallest turning radius: 3.5 m.; ground pressure per cm²: 0.14 kg.

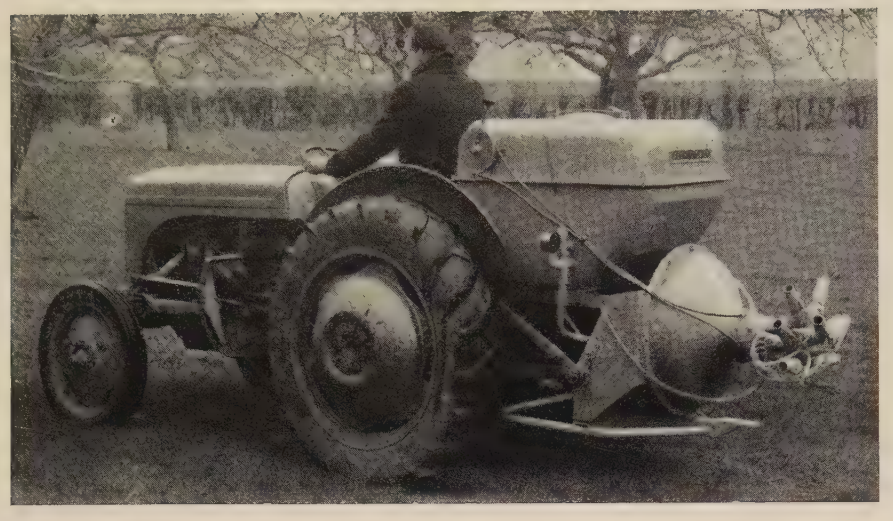
AB Nordverk, Uddevalla, Sweden.



JOHN DEERE 440 CRAWLER TRACTOR AND 63 BULLDOZER. — *Tractor specifications*: Horsepower: drawbar 24.12, engine 29.72; 5 speeds fwd. 1.14 mph to 7.34 mph (1.83 to 11.81 km/h), 1 rev. Gasoline engine: 4 cylinders; rated governed speed 1850 rpm. Track trend: 48 in. (1.2 m.); turning radius: 6½ ft. (2 m.); length overall 105½ in. (2.7 m.); width overall 51⅓ in. (1.3 m.); ground clearance: 12 15/16 in. (33 cm.).

Bulldozer specifications: Blade 72 in. or 88 in. (183 or 224 cm.); height of lift, 37 in. (94 cm.); depth of cut, 11 in. (28 cm.).

John Deere Industrial Division, Moline, Illinois, U.S.A.



Tractor-Mounted Sprayer. — Tractor-mounted sprayer equipment "Conomist" fixed on 3-point linkage of Ferguson or similar tractor; flexible coupling from tractor p.t.o. shaft to all-enclosed gearbox. Drive for the fan through centrifugal coupling. Separate extension shaft to drive 10 gal. (45 l.) per min. Roller Vane Pump. 315 liter fibre-glass tank fitted with liquid agitation. Nozzles rotated from tractor driver's seat, valve within reach of driver provides instantaneous cut-off. Has 8, 4 or single nozzle. Single nozzle carries furthest for forestry work, 16 h.p. absorbed by fan, spray thrown a great height using this 4-in. (10 cm.) outlet. Air speed about 240 mph (386 km/h).

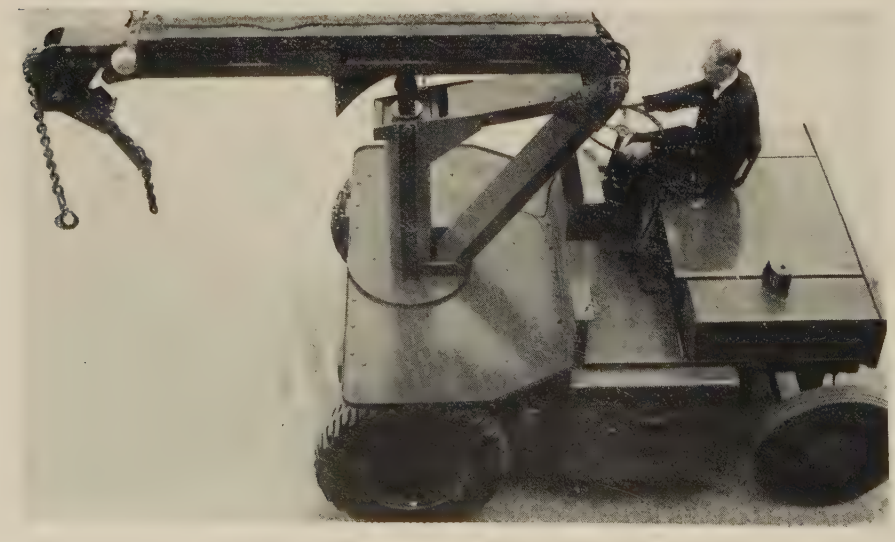
Kent Engineering and Foundry Ltd., Phoenix Works, Tovil, Maidstone, England.

Model 300 Rotomist. — Designed for spraying very high trees. Direction of the air tunnel hydraulically controlled by operator. Mechanical agitation of spray material whenever engine is running. Spray hose and gun employed for spraying inaccessible places using full capacity of pump.

John Bean Division, Food Machinery and Chemical Corporation, Lansing 4, Michigan, U.S.A.

Smallford Automatic Tree Planter. — Designed to fit on 3-point linkage of any tractor, sturdily built. 15 in. (38 cm.) disk in front of the opening coulter cuts bracken and small roots and also lifts machine over large hidden obstacles. Non-slip drive wheel ensures mechanically accurate spacings to individual requirements, ranging from 12 in. to 7 ft. (30 cm. to 2.1 m.) sets. Tree seedlings gripped by means of sponge rubber clamps, adjustable to type and size of plant.

The Tractor Shafts Co. Ltd., Smallford, St. Albans, England.



BHC Iron Fairy. — Designed for handling of all classes of load ranging from 1 to 2 tons. Telescopic slewing jib can extend or retract hook. Hydraulically controlled. 3 levers provided for slewing, raising and lowering; additional hand control adjusts rate of descent of load. Equipped with 37 b.h.p. petrol engine or 30 b.h.p. diesel. Lockheed hydraulic brakes fitted to all 4 wheels.

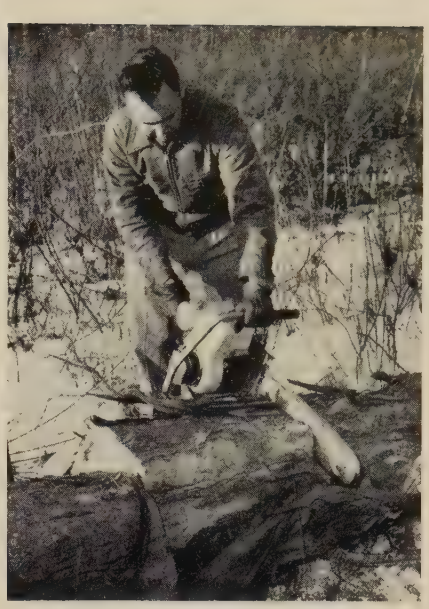
British Hoist and Crane Company Ltd., Compton, Berkshire, England.

LODESTAR. — 7 models from 250 lb. (113 kg.) to 2,000 lb. (907 kg.) capacity, and equipped with a ¼ or ½ hp motor. Weight from 51 lb. (23 kg.) to 68 lb. (31 kg.) capacity. For 220 volts or 440 volts. Standard lift 10 ft. (3 m.). Can be supplied for lift up to 90 ft. (27.4 m.) on single chain models and 45 ft. (13.7 m.) on double chain models. Hook or trolley suspension.

Chisholm-Moore Hoist Division, Columbus McKinnon Chain Corporation, Fremont Ave., Tonawanda, N.Y. U.S.A.

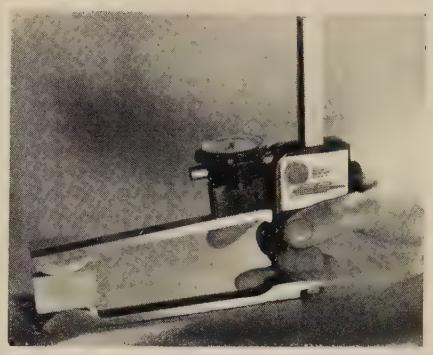
PORTER-CABLE GAS CHAIN SAW. — Model 530 direct drive chain saw available with 16, 20 or 24 in. (41, 51 or 61 cm.) bar sizes, cuts logs or timber up to 48 in. (122. cm.) in diameter. Weight 24 lb. (11 kg.). Engine 3.5 brake horsepower. Available with float or diaphragm carburetor.

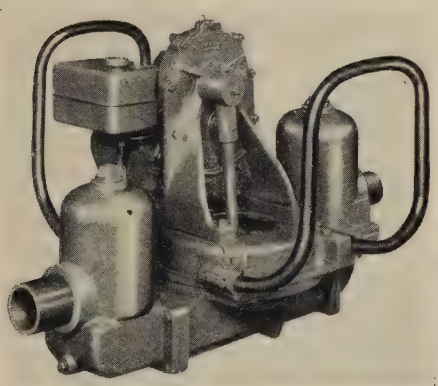
Williams and Jensen International, Porter-Cable Export Dept., Bank of South Haven Bldg., South Haven, Mich. U.S.A.



MATER CONTROL GAGES. — Measure variation in thickness or width of sawn or planed lumber from standard dimensions required. Thickness gage set from 1/16 in. (1.6 mm.) for veneer up to 4 ½ in. (11.4 cm.). Width gage set for any width from 4 in. to 12 in. (10 to 30 cm.). Gages ruggedly constructed for sawmill use. Plus or minus variation in size read directly on dial indicator in either fractions to min. 1/64 in. or decimals to 0.005 in. (.013 mm.).

Mater Machine Works, Inc., Corvallis, Oregon, U.S.A.





"MUD HOG" DIAPHRAGM PUMPS. — 302B Model lightweight all-aluminum Mud Hog diaphragm pump, rugged and extremely portable. Lifted by two men and easily wheeled by one man.

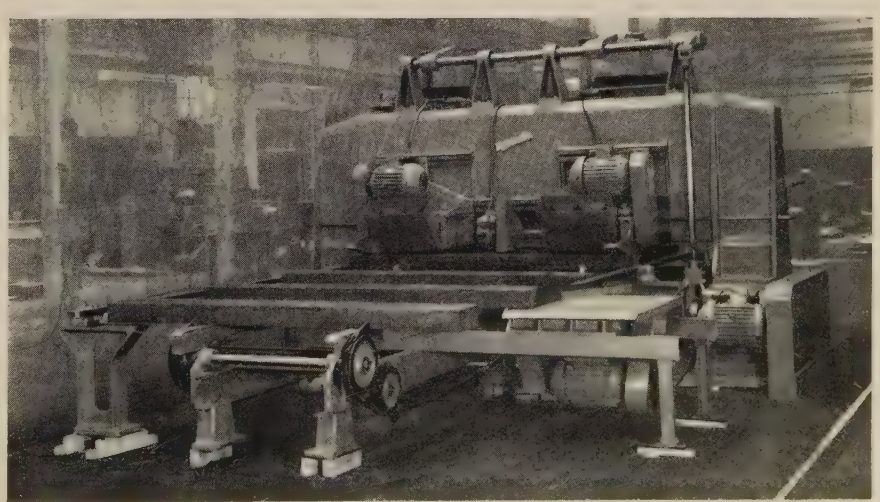
Specifications: Overall lengths 38¾ in. (98 cm.); overall width 32¾ in. (83 cm.); overall height 27¾ in. (70 cm.); net weight 137 lb. (62 kg.); strokes per min. (normal and governed engine speed of 3,300 rpm) 60; 2.25 hp at 3,300 rpm.

Marlow Pumps, Division of Bell and Gossett Company, Midland Park, New Jersey, U.S.A.

AUTOMATED MACHINE FOR RAILWAY SLEEPERS. — Trims, marks, adzes and bores railway sleepers at rate of 10 per min. Controlled by one man from central panel. Handles sleeper lengths from 6 to 9 ft. (1.8 to 2.7 m.); nominal widths of 8 in, 10 in., or 12 in. (20, 25 or 30 cm.) and nominal depths of 5 to 6 in. (13 to 15 cm.).

EJ/T adzer and borer motor driven throughout, comprises infeed conveyor, cross-cut saw. Infeed conveyor consists of two steel chains with dogs. Drive taken from the machine's feed gearbox. Cross-cut saw 24 in. (61 cm.) in diameter. A sawdust hopper for connection to exhaust system included. Saw spindle is driven from 10-hp motor. Has 2 independent, horizontally adjustable, adzing spindles and 2 boring head units. Infeed and outfeed conveyors are chain driven.

Thomas Robinson and Son Limited, Rochdale, England.



News of the World

Canada

• A 370-year-old and 275-foot (84-meter) arrow-straight Douglas fir was selected by the forest industry of British Columbia as its Centennial Year gift to the people of the United Kingdom. When erected as a flagpole in the Royal Botanic Gardens at Kew, London, it will be the tallest flagpole in the world.

After being felled, the stem was cut to a length of 226 feet (68 meters), loaded on false bunks on top of two loaded logging trucks and delivered to a beach 25 miles (40 kilometers) away where it was dumped in the water and towed to Vancouver Harbor.

Two floating cranes loaded the 36-ton log aboard a freighter where it rested on a deckload of lumber bound for the port of London. Here the big pole was dumped into the Thames river and then towed up to Kew for seasoning and dressing. It will eventually stand 214 feet (65 meters) above the ground.

• Increasing interest on the part of the pulp and paper industry in the use of sawmill chips for pulp, together with improvements in design and operation of barkers and chippers, have made most of the larger sawmills in Eastern Canada, and many of the relatively small ones, potential pulp chip producers. Considerable information on processing methods and costs are available, but there has been a lack of reliable data on several important factors concerned with the development, by a sawmill, of a chip program.

One of the most important of these factors relates to the determination of the yield of suitable residues which may be expected as a result of the conversion to lumber of sawlogs of various sizes. Fairly accurate knowledge on this is a prerequisite to the determination of the feasibility of a chip program, as well as to the determination of the type and capacities of processing equipment for any particular sawmill. The yield will depend on the types of saw used, the accuracy of sawing, and the utilization standards of the mill.

A bulletin entitled *A Pulp Chip Program to Utilize Sawmill Residue* (Forest Products Laboratories Technical Note No. 7) provides data which should prove most useful to sawmill operators contemplating a pulp chip program.

Cuba

• During a short stay in Cuba to appraise the forestry situation, at the request of the Government, an FAO technical assistance officer, Mr. L. Huguet, visited all the main plantations on the island, either of native species or exotics. In the case of the former, small 1- or 2-hectare plantations of cedar (cedro), mahogany (caoba) and *Calophyllum calaba* — a gumyielding tree (ocuje, also called calambuco) are not considered as of much economic importance. It is common knowledge that cedar plantations are difficult to establish and that the Cuban caoba grows very slowly. It seems that there is only one relatively extensive stand of *Pinus caribaea*. This plantation in Topes de Collantes is of considerable interest because the trees, planted on fairly good soil at an altitude of 700 meters with a humid climate, have been growing at the rate of 2 centimeters per year in diameter and 1 meter in height. The standing volume after thinning is 150 cubic meters per hectare at the age of 17 years.

As regards exotics, eucalypts are the most widely planted and have always had great success on the most various soils. *Eucalyptus saligna* has given the best results.

The most interesting plantations are those established over the past eight years by the *Minas de Matahambre* company in the province of Pinar del Río, and which already cover about 600 hectares. Here on poor quality soils *E. saligna* attains an average of 25 meters in height and 20 centimeters in diameter within 7 years, and the form of the trees is practically perfect. The planting methods are simple and well known and the cost of establishment is no more than 200 pesos (U.S.$200) per hectare. If eucalypts were to be planted on extensive flat areas, operations could be mechanized, reducing the cost.

Other plantations established by the *Central Beragué* on better type soils, suitable for sugar cane, showed hardly more growth than the *Matahambre* plantations. The species used are *E. saligna*, *E. trabuti* and *E. deglupta*. On very poor serpentine but nonlateritic savannas of Camagüey, a small plantation of *E. saligna*, 2½ years old, was growing well, with heights of 6 meters.

Teak (*Tectona grandis*) has been planted on fertile soils; increment seems to be less than in the case of plantations on the island of Trinidad, but is still very good. *Acacia decurrens* and *A. mollissima* growing at low altitudes in nurseries with excellent soils do not seem to do well.

The large sugar companies are establishing plantations on surplus farmlands in order to obtain homegrown supplies of railway crossties (sleepers) and poles; the mining companies to produce mine timbers. Poles and frames for drying tobacco are in demand, and it is reported that paper and rayon mills are interested in pines and eucalypts. Planting projects therefore appear to be good business.

Dominican Republic

• A report to the Latin-American Forestry Commission recalls that Law No. 4389 (19 February 1956) set aside a forest reserve (the Armando Bermúdez National Park) for scientific purposes, nature protection, and particularly the protection of the watersheds of five rivers. In compliance with this law, the process of expropriating private property located within the bounds of the national park has continued and families who lived within the area have been relocated elsewhere, each receiving land sufficient and appropriate for its needs. A forest ranger corps has been created to develop the national forest resources, mainly in this national park but also in the timber-producing areas where the felling of pine for agricultural purposes has also been prohibited.

Law No. 4371 (29 January 1956) declared reforestation and afforestation throughout the country to be in the national interest. Later the President, on his personal initiative, proclaimed the year 1956 to be Reforestation Year. The Ministry of Agriculture put into effect a reforestation campaign and established 23 nurseries, one in each province, for

producing forest trees and fruit and ornamental trees. The plants are distributed for planting out on private farm holdings, state and municipally-owned land, and to embellish avenues, parks and highways.

Ethiopia

• Several years of technical assistance, under both bilateral programs and the FAO program, have given momentum to an extensive program of forestry development, according to a report to FAO.

The Forest Department in the Ministry of Agriculture has been reorganized and a new building to house it is under construction. An Imperial Ethiopian Forest Service (field service) consisting of forest conservatorships in the 13 provinces with the necessary administrative organization, is being developed. By the end of 1958, seven of these conservatorships will have been established.

A forest rangers school has been founded in conjunction with the agricultural college at Ambo. Courses have started. A forest research institute is also being established at Ambo; the necessary buildings are under construction and scientific equipment has arrived. A National Park at Managasha (near Addis Ababa) is being created, to serve as a school forest for practical training for the rangers school and as a model managed forest.

An aerial reconnaissance has been carried out and the location, approximate area and general composition of forest areas have been ascertained. Some forest regions of special importance have been photographed from the air and mosaics made up as a basis for planning. A new forest law is under discussion in parliament and is expected to be passed.

The commercial exploitation of existing forests is being brought under control. Utilization will be on a working plans basis, founded on permanent forest industries and prescribed regeneration operations. 18 foreign technicians will have been engaged by the end of 1958. Professor Franz Heske has been appointed Director-General of the Forestry Department.

French Equatorial Africa

• Pointe Noire in the Middle Congo was the location for the second Inter-African Forestry Conference (3 to 10 July) organized by the Commission for Technical Co-operation in Africa South of the Sahara (CCTA). Representatives attended from Ghana and from territories of France, Belgium, Portugal and the United Kingdom. FAO had an observer present as at the first such conference held at Abidjan in 1951.

After considering the present situation in respect of forest policy in countries south of the Sahara, the Conference covered a wide range of technical topics including the natural reconstitution of forests in areas under exploitation and traversed by shifting cultivation (nomad agriculture); planting methods for indigenous species and exotics; measures to obtain a biological balance in land utilization; and the maintenance of a sustained yield from the forests of tropical Africa. Technical committees dealt with the nomenclature of African forest formations and with Miombo-type woodlands which cover at least 2,590,000 square kilometers (1 million square miles) of the continent.

Views were expressed as to the future scope of the forestry activities of CCTA particularly in regard to research, and on the form which future collaboration with FAO should assume after the establishment of the new FAO African Regional Office with its sub-regional offices in East Africa and North Africa. The FAO Regional Representative will be Mr. Pierre Terver who served for many years with FAO's Forestry Division and has lately been Director of the Program and Budgetary Service in the Director-General's Office. Mr. Terver spent a large part of his early career in Africa.

Nicaragua

• Nicaragua is a country with extensive areas of dense forest. The actual area was estimated in 1950 by an FAO Mission to be 17.5 million acres (7.1 million hectares) or over half the area of the country. These immense resources have tended to overshadow the very real need for forest conservation and efficient utilization.

At present the forest industry in Nicaragua is very small and in no way reflects the immense reserves of the country. The present annual value of exports of all forest products is less than $4 million coming predominantly from the Atlantic Coast, while the value of timber supplied to the local market is probably of somewhat less value. However, with such reserves of timber it is feasible to build the export of timber from the whole country up to an equal or greater value than coffee or cotton exports, an FAO technical officer suggests.

This diversification would be of great advantage as a stabilizing influence on the economy, for timber prices are much less variable than most crops and the annual output, being little subject to variations due to climatic conditions or pest infestations, is much more predictable. As well as the good export possibilities, it is probable that with more efficient production and subsequent lower prices, the local demand for timber for all purposes would rise at a far greater rate than the increase in population.

However, due to local depletions of the reserves near centers of populations, prices of timber products in Nicaragua are increasing, and without conservation measures this steady depletion of timber will lead to even higher prices. Even now the timber reserves of the Pacific Coast have been so depleted that it is very profitable for even small scale operators near roads to ship timber over 200 kilometers to the Managua market. The major reason for this depletion of timber reserves is due to clearing of land for agricultural purposes, mostly with destruction of the standing timbers by burning, as the lack of roads makes it impossible to forward the timber to market.

This process has been, and is still being repeated throughout Nicaragua. Settlement has always preceded road construction, and by the time suitable roads are built, only a small fraction of the commercial timber remains. Further, the lack of any efficient system of utilization, lack of knowledge on the uses of each species, and the small amounts available have made it often unprofitable to extract what little timber remains. These are the general problems facing the timber industry in Nicaragua.

Portugal

• Last April a project for a six-year development plan (1959-65) was submitted to the National Assembly. This new plan envisages a total investment of 21 million contos (U.S.$725 million) almost double that for the first plan (1953-58). Since the gross investment capacity of the country for this six-year period is estimated at about 68.5 million contos (U.S.$2,366 million), this means that some 30 percent of total investment will be controlled by the national administration.

The new plan also shows a significant change in the proportion of investment allotted to agriculture, forestry and livestock farming: the 10.8 percent of the first plan has been increased to 17.3 percent. For forestry which furnishes 30 percent

of the country's exports, the total amount allotted is 750,000 contos (U.S.$2,475,000) or 21 percent of the funds for the agricultural sector.

More than half this amount is to be invested in afforestation, carried out by the Forest Administration and to cover somewhat more than 100,000 hectares. It is recognized that forestry provides about the only way to rehabilitate the great portion of the country which is either mountainous or where the soils are very poor. In the south of the country alone, one million hectares ought gradually to be transferred to forestry from the cultivation of cereal crops which not only results in considerable erosion but also gives very low cash returns. Experience in Portugal shows that yields of 700, 1,200 and 1,000 escudos (U.S.$24,$40 and $34) per hectare can be obtained from pine, eucalyptus and cork oak plantations, figures which are rarely attained by wheat or rye cultivation in this region.

The State afforestation program is expected to be supplemented by planting operations carried out by private landowners, benefiting by the special facilities granted by a law of 24 April 1954. This law provides for exemption from taxes, preferential credits, facilities for the supply of seeds and plants, and free technical assistance for owners of land where afforestation is considered indispensable to soil conservation. A total of 81,000 hectares are expected to be afforested under the provisions of this law.

About 20 percent of the total forestry investment is to be devoted to supplementary works — roads, buildings, telephone lines, meteorological stations, etc., — the "infrastructure" of forest development.

Forestry developments in the Azores also occupy an important place in the plan. Since the conditions on the islands confine cultivation to a narrow coastal strip, grazing by livestock is the main support of the islands' economy. Most of the islands are suitable for cattle breeding, and it is certain that a program of range improvement would contribute greatly towards increasing the production of meat, which is a scarce commodity in the Portuguese economy. Range improvement will consist mainly of eradication of scrub, artificial seeding of valuable grass species, and planting of trees for shelter, the whole covering a total area of 15,000 hectares. Fencing over 160 kilometers is also being considered — a measure of particular importance in the Azores where deep ravines are a serious menace to the security of the livestock and often entail their being kept away from good pasture zones.

Romania

• The reeds of the Danube delta supply the raw material for an international pulp enterprise at Braila constructed under the auspices of Comecon (council for mutual economic co-operation). Romania has half-shares in the project, and the other participants are Czechoslovakia, Poland and east Germany. The plant is planned to produce initially 50,000 tons of pulp per year, to be doubled later, as well as derivative products such as textile fibres, paper, fodder yeast and various chemicals.

The harvesting of the reeds which is being organized from Tulcea at the head of the delta, takes place between November and April and is emerging from the experimental stage. The objective is to replace the present process of manual cutting by seasonal labor, with full mechanization using reed-cutting machinery and marsh-going tractors. Many imported machines have been tried out and other modified types have been constructed locally.

Union of South Africa

• More than £50 million (U.S. $140 million) are said to have been invested by the State and by private interests in extensive afforestation programs, using fast-growing exotics. The weighted average for the annual increment for all exotic species in South Africa is 11.195 cubic meters per hectare (160 cubic feet per acre), and the short rotations possible with these species has brought them rapidly into production, to the extent that plantations are now the major domestic source of supply for the wood-using industries.

Over the last ten years sawlog production has increased by 80 percent; output in 1956/7 was 937,000 cubic meters of coniferous wood and 235,000 cubic meters of broadleaved wood. Production of sawnwood increased by 70 percent in the period between 1954/5 and 1956/7. In the latter year 154,000 cubic meters of boxboards were produced. A rising demand for pitprops for the coal and gold mines has been met mainly from privately owned plantations of broadleaved species. The total output of 1,215,000 cubic meters of pitprops in 1956/7 was double that of 1936/7.

In 1957, exports from South Africa of forest products amounted to about £7,000,000 (U.S.$19,600,000) in value. They included 45,000 metric tons of pulp and 28,000 tons of fibreboard. Both these and the plywood and particle board industries are now well established, with expanding outputs. Imports of forest products in recent years amounted to about £ 30,000,000 (U.S.$84,000,000) annually. In 1957 the major items were sawlogs and sawnwood (700,000 cubic meters) and paper of all kinds (167,000 metric tons). However, with the exception of lumber for construction and furniture, and of certain pulp products, the proportions of South Africa's requirements which are produced domestically are either being maintained or are rising.

Union of Soviet Socialist Republics

• Various articles in recent issues of *Liesnoie Khozyaistvo* (Forestry) have dealt with the development of forest management systems in the U.S.S.R. The forests that are worked for industrial timber are logged by units (*liespromkhozes*) which come under the Ministry of Forest Industry and are completely independent of the forest management units (*lieskhozes*), which come under the central authority of the Ministry of Forestry. Lack of liaison between the two often raises many difficulties.

This organizational structure was reached only through a trial and error process.

When the Soviets took power in 1917, the State appropriated all forests, whether belonging to private persons or to communities. All forests were made government property by the basic law of 27 May 1918. But this did not solve the question of the optimum utilization of the immense forest resources thus concentrated in Government hands.

During the NEP (New Economic Policy) period priority was accorded to the wholesale mobilization, by any means, of all the country's resources usable for economic development. Logging concessions were granted in certain forest areas, even to foreign firms. In 1919, for instance, considerable areas of northern forest were leased to a Norwegian company for logging. A Dutch company, which had previously had a contract with a private owner, continued to work a 4-million hectare area in the northern Dvina basin until the middle of 1919. In the Far Eastern taiga and in the central parts of the country, concessions over 5 million hectares were given to a company called "Mologolies", which harvested 1.5 million cubic meters of timber per year. Naturally this company was under government supervision and its activities had to follow prescribed management plans.

This formula did not produce the results anticipated, and there arose the idea of leasing certain forested areas to forest co-operatives. In 1921, for instance, a project was worked out for the 35-year lease of a forest area in the basins of the Pasha, Oyat and Svir rivers. Soon, however, it appeared necessary to abandon entirely the system of granting concessions or leases.

During the next 20 years other methods of dividing functions on government-owned forest lands were developed. For instance, a forest area of over 1½ million hectares in the Archangel region, was made a land settlement area where extensive tracts of forest could be gradually cleared for settlement and agriculture. At the same time the first centers for the supply and distribution of forest products on a long-term basis were organized along present-day lines. In 1925, over 10.5 million hectares of forest were assigned to 11 such extraction centers to obtain an annual production of 11.9 million cubic meters. Certain forest areas were allocated to scientific institutes, technical schools, etc., but the total so allocated was only 4.6 million hectares, including the 1.1 million given to the State farms (*sovkhozes*). Management of these stands remains the responsibility of the body to which they have been assigned, always under Government control.

From 1931/32 on, this system of allocating forest areas was extended to industrial organizations charged both with the logging and silvicultural management of the stands. However, it was found that the latter function was neglected and that industrial organizations, in particular, were little concerned with the regeneration of cut-over stands. This system was rejected in 1947 in favor of the system now in use.

Although the *lieskhozes* have the authority to see that logging operations are carried out with due regard to silvicultural requirements, there is plenty of room for improvement. After logging a considerable amount of timber is found, especially hardwoods, left standing or fallen to waste. Moreover the *lieskhozes* are often handicapped in carrying out regeneration operations by shortages of machines and labor.

United Arab Republic

• It has been claimed that, in parts of many Near East countries, tree planting could be a better business than raising agricultural crops. Figures have been calculated for the net income per hectare of different types of cultivation in Syria as follows:

Product	*Net annual income per hectare (Syrian pounds)*
Vegetables	1 000 – 1 500
Fruit trees, vineyard, cereals, cotton	1 250 – 1 750
Poplars on a 13-year felling cycle	3 500 – 4 000
Poplars on a 40-year felling cycle	4 000 – 5 000

Under the more favorable growth conditions in Egypt, poplars could probably give the same results in 25 years as in Syria over 40 years. A rotation of 12 to 15 years should be sufficient to produce logs, at present imported, for the match factories. One row of poplars planted as a windbreak at an interval of two meters between trees should yield about 100 Egyptian pounds for every 100 meters over 12 to 15 years: £25 from the first thinning after 6 to 7 years, £25 from the second thinning after 10 years, and £50 from the final crop. Similar results could probably be achieved with other fast-growing tree species. Experiments are being conducted to ascertain what can be produced.

United Kingdom

• The first issue of the *Journal of the Institute of Wood Science* (21, College Hill, London, E.C.4) appeared in March. The institute, which was formed in 1955, has as its purpose the advancement of the scientific, technical, practical and general knowledge of wood and allied subjects. The new journal, which will appear twice per year, is to publish original work on all aspects of wood science, whether it be pure research of a theoretical or laboratory kind or more directly development work. The first issue contains papers on the botanical, physical and chemical aspects of wood science.

A new monthly technical publication has also appeared this year. With the title *Board* (published by Industrial and Commercial Publishers Limited, 13 New Bridge Street, London, E.C.4) the periodical is claimed to be the only one in the world to deal exclusively with hardboard, insulation board, particle board and allied products. Among articles in the first issue were ones dealing with fire resistance treatments for fibreboard the manufacture and use of particle boards, world output of board products, and synthetic resins. Separate sections are devoted to "Oversea Reports" and to "Materials, Machinery and Tools".

United States of America

• An area in the White Mountains of Inyo County, California, which contains the oldest living things of earth — bristlecone pine trees — has been designated as a reserved forest by the United States Department of Agriculture. The Chief of the Forest Service has signed an order establishing the forest within the Inyo National Forest and providing for its administration for botanical and historical purposes and for public enjoyment.

The area designated includes 27,000 acres (10,000 hectares) along the crest of the White Mountain Range. Within it are 100 bristlecone pines (*Pinus aristata*) over 4,000 years old and thousands in the 3,000 to 4,000 age bracket.

A grove of the oldest trees will be named the Edmund Schulman Memorial Grove in honor of the man who discovered in 1957 that the ancient bristlecones were the oldest living things in the world. The discovery was the culmination of 20 years of research by Mr. Schulman among old trees. His findings aroused widespread interest when reported by the National Geographic Society in its magazine.

• A Forest Biology Committee with a nationally representative membership has been set up by the Technical Association of the Pulp and Paper Industry (TAPPI). Its purpose is to secure interchange of information between forest biologists and specialists in the fundamentals of pulping and paper making, and to stimulate research in subject areas of forestry that are of direct concern to TAPPI. In the initial phases, attention will be devoted primarily to forest genetics and forest tree improvement, as they relate to wood as a raw material for the manufacture of pulp, paper and board. Later the committee will concern itself with other factors influencing pulpwood quality such as forest fertilization, tree spacing and wood-decaying fungi.

Another example of industry's concern with research is indicated in a brochure, *Modern Methods of Manufacturing Veneer and Plywood*, (United States Machinery Company, Inc., 90 Broad Street, New York). Here it is claimed that experimental work and broad experience with the various woods and climatic conditions now permits recommending the proper

equipment for cutting, drying and gluing in practically every country of the world where timber is available.

• Writing in the *Journal of Forestry*, Professor Stephen Spurr suggests that few problems of forest terminology have evoked so much confusion as the usage of the terms *selection* and *selective*. They have come to be used in so many senses as to make effective communication difficult between even well-trained professional foresters. It is high time that an effort be made to define these terms so as to take into account their ordinary usage by foresters. He suggests the following set of definitions:

1. *Uneven-aged management*: A system of silvicultural management involving selective or partial cuts repeated at intervals with the object of creating and maintaining an uneven-aged forest stand. Syn. *selection method, selection system.*
2. *Selective cutting*: Any cutting in which trees are marked or otherwise chosen for removal in preference to other trees that are left uncut. Syn. *partial cutting.*
3. *Marked-tree cutting:* A specific type of selective cutting in which the choice of the trees to be cut or left involves the independent judgment of the forester, as opposed to partial cuts based upon arbitrary rules.
4. *Thinning:* A type of selective or partial cut made for the purpose of stimulating the growth of the residual trees as opposed to partial cuts made for the purpose of realizing stumpage values or for the purpose of obtaining natural reproduction. Since all thinning involves the act of selection, the term *selective thinning* is both redundant and confusing, and should be avoided. Specific types of thinning can be indicated by carefully chosen modifiers (i.e., *crown thinning*).

Venezuela

• Earlier in this issue is an article on the development of the Forest Products Research Institute in the Philippines.

In recent numbers of *Unasylva* there have been several references to the Latin-American Forest Research and Training Institute at Merida. The devoted support of Dr. Uzcategui, Director of the Institute, Dr. Rincon, Rector of the University, and Professor Viloria, Dean of the Forestry Faculty, has been a major factor in the initial success of this Institute, together with the close collaboration developed with professors of the Forestry Faculty of the University of the Andes.

Set on a high plateau in the shadow of Mount Bolivar and Mount Pico, imposing snowy peaks of the Andes, the Institute is impressively equipped and, by means of laboratory and field research, efforts are being made to solve some of the problems facing governments and private wood-using industries in opening up the natural forests of the region to sound exploitation.

The intimate connection between extracting useful products from the forest and the agricultural development of steep slopes requires that colonization schemes and rural resettlement must be based on carefully worked out research on soil-vegetation relationships, and more comprehensive knowledge of the potentialities of local tree species, as well as of modern methods of soil conservation and watershed management practices. Failure to do so can only serve to aggravate the already serious menace of soil erosion and its many disastrous consequences.

The work of the institute in forest ecology is laying the basis for a better understanding of the forest as a protective cover and as a source of wood products, and is already finding application in the plans of the Venezuelan Government for agricultural development and colonization. Knowledge is being built up as to growth and seeding habits of many forest species. In the process of building up this knowledge, the students of the Forestry Faculty are receiving much useful training in the establishment of sample plots in the forest, measuring the trees, and analyzing the effects of silvicultural treatment on regeneration and early development of the stands.

Systematic testing has started of wood specimens of many Latin-American species, and the results are being compiled for the use of interested industries. This service of testing woods bids fair to increase as more countries avail themselves of the Merida laboratory facilities. A large museum-display room is being arranged, where visiting industrialists can see examples of woods of local species made up into a number of products.

Book Notices

Textbook of Dendrology. William M. Harlow and Ellwood S. Harrar. 560 pp. Illus. 4th edition. McGraw-Hill Book Company. New York and London. $7.00, £3. 8s.

This book, one of the American Forestry Series, is designed for beginner students of forestry, describing the important forest trees of the United States and Canada. Like its predecessors, the fourth edition emphasizes the taxonomic features of families, genera and species, and gives the silvicultural characteristics and geographical distribution of the major species. Nomenclature, classification and references to the literature have been brought up to date. The authors have felt that students of forestry should first know well the commercial species of North America and then become familiar with the less important trees and shrubs of the locality where they may find themselves practicing forestry. The latter must usually be done by the student himself with the aid of a local tree manual.

It is to be hoped that, at some stage and through some agency, a similar concise textbook will become available about important Central and South American species.

Lumber. Nelson Courtlandt Brown and James Samuel Bethel. 380 pp. Illus. 2nd edition. John Wiley (New York) Chapman and Hall Ltd. (London) 1958. $9.00.

The first edition of this publication appeared in 1947. Since then, many technical advances have been made by the lumber industry, making necessary a revision of the original text. Increased labor costs, a steadily decreasing quality of raw material, and competition from other materials for markets, are cited as reasons for changes in methods and procedures.

Increased attention is given in this second edition to the subject of mill layout and handling of mate-

rials. The chapter on small sawmills has been eliminated and the pertinent material transferred elsewhere, reflecting the trend in the south and east of the United States away from portable mills toward small permanent installations, and the trend in the West to combine small sawmills with large.

The preface says that perhaps the most significant addition is a new chapter on quality control. The application of statistical quality control methods to lumber manufacture is a significant new development in all major manufacturing areas. Because this technique is new to the wood product field, more detail of the basic statistical concepts and control chart methodology has been included than might otherwise have been introduced into a textbook on lumber.

The chapter on lumber drying has been expanded to cover new developments in kiln and air drying. A new chapter has been added on advances in the use of wood residues and the production of allied products by lumber manufacturing enterprises.

This edition will maintain the reputation of *Lumber* as an excellent textbook for professional forestry schools and as a reference volume for the whole lumber industry.

Forest Soils. S.A. Wilde. 538 pp. The Ronald Press, New York, 1958. $8.50.

Some understanding of forest soils began with the ancients and with various so-called primitive tribes and peoples to whom the understanding was essential as a means of survival. As the beginnings of what may be called science developed, attention to this broad subject of course continued.

A major impulse to the understanding of forest soils was provided by the breakdown of spruce in Saxony in the early part of this century, and various students were led to take a new look at some obviously ill-understood problems of forest soils and their productive use. The author of this latest American teaching text regards the German forester, Grebe, as having laid the cornerstone of modern soil science and ecology in 1840, and considers that Hilgard in 1906 laid the foundation of modern forest ecology.

As the bibliography of this excellent text indicates, a very large number of professional publications originating in many countries have since appeared.

The present textbook is divided into two major parts, the first dealing with soil as a medium for tree growth, and the second with soil science and silviculture — that is respectively with the scientific foundations and the applications.

In the relation of forest vegetation to soils it is necessary to understand the general process of forest succession and to study various widely differing major areas of the world in which the soils and the forest vegetation present great contrasts. The areas covered in this book include Karelia, the Great Lakes region of the United States, the Dnieper Basin of southern Russia, the driftless area of Wisconsin in the United States, the Landes of France, and several others.

Modern methods of forest soil surveys, which have developed rapidly, are necessary for obtaining and using a knowledge of soils effectively. One of these uses is in deciding on areas on which reforestation may be successful, on methods of planting best suited to different soils and soil types, on the whole battery of methods available for dealing with unproductive soils, including drainage, fastening down blowing sands, dealing with spoil banks, burning, fertilization, etc. In this whole field of practical application, the means now available are far greater than in earlier times, and it is clearly important for the practitioner to have readily available all the solid information which has been accumulated.

Lexique Pédologique Trilingue. (Trilingual Lexicon of Soil Science) G. Plaisance. Mimeographed. 357 pp. Centre de Documentation Universitaire. Paris. 1958. 1,500 fr.

The establishment of a multilingual terminology is especially difficult in the case of soil science, although this is one of the fields in which it would be particularly useful. The attempt made by FAO some time ago (*Multilingual Vocabulary of Soil Science*, 1954) restricted itself to a limited number of terms and definitions. Any attempt to make an improved international terminology was therefore to be welcomed.

This is what Mr G. Plaisance has successfully attempted in publishing his trilingual soil lexicon (French - English - German) which contains about 3,300 words. One innovation is worth noting as it offers a more solid basis on which the desired international co-ordinated terminology might be built. The annexes give in a clear and concise way the equivalents of the different terms relating to soil properties used by the various schools of soil science.

The Physiology of Forest Trees — A Symposium. Edited by K.V. Thimann. 678 pp. illus. The Ronald Press, New York, 1958. $12.00.

The Maria Moors Cabot Foundation performed a valuable service in making possible the holding of this symposium at the Harvard Forest in April 1957. The volume contains the papers and the results of the discussion by a number of outstanding research workers actively engaged in studying tree physiology or closely related fields. The participants came from Canada, the United Kingdom, Norway, Germany, New Zealand and various parts of the United States.

Many texts on plant physiology already exist. But this symposium dealt with *tree* physiology, and brings together the latest results in a field which has seen phenomenal progress thanks to new techniques, such as the use of radio-isotopes. This progress is set forth, in most of the papers, in relation to the earlier state of knowledge, and the result is a veritable textbook for research workers concerned with silvics, ecology, genetics, and silviculture.

The comprehensive nature of the book can be judged from a listing of the chapter titles: Water relations and sap movement, photosynthesis, biochemistry, mineral nutrition, phloem transport, root growth and other growth phenomena, photoperiodism and thermoperiodism, and reproduction.

According to the preface, this was the first international symposium on forest tree physiology. It is sincerely to be hoped that the Maria Moors Cabot Foundation will be able to sponsor future symposia at suitable intervals in this rapidly developing field which is basic to an understanding of the complex biological phases of forestry.

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RECENT FAO PUBLICATIONS

The State of Food and Agriculture 1958 — *$2.50, 12s. 6d.*

An annual report. This year's issue, in addition to a summary of the food and agricultural situation, provides a world review and outlook, covers food and agricultural developments in Africa South of the Sahara and discusses the growth of forest industries and their impact on the world's forests. There are numerous tables, charts and graphs. English, French and Spanish editions.

Yearbook of Food and Agricultural Statistics - 1957

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